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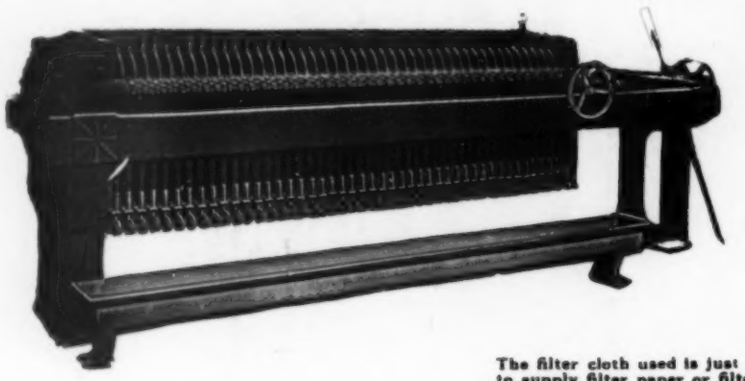

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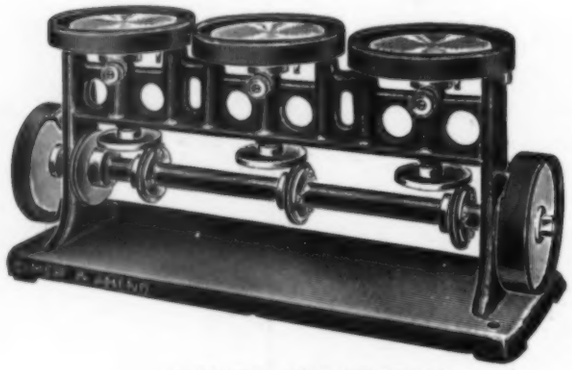

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CHEMICAL & METALLURGICAL ENGINEERING

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H. C. PARMELEE, Editor

Volume 28 — New York, May 21, 1923 — Number 20

Making the Debtor Pay

SOMETHING of the element of surprise accompanied the announcement on May 16 that French and Belgian troops had occupied four of the largest dye plants of the great German combine. Yet it was but a logical step in France's avowed policy of making a bad debtor pay his just debts. When Berlin on Jan. 13 notified the French Government that because of the Ruhr occupation Germany was suspending all reparation deliveries, she inevitably contracted for just such a counter-move on the part of the allies. The fact that it was a store of dyestuffs worth 4,000,000,000 marks that was confiscated was probably of no more significance to France than would have been an equally valuable stock of coal or iron ore. To the chemical industries of the world, however, this move has a more sinister portent.

The dyes seized by the French will come into immediate competition with products of our chemical industry. Directly this competition may appear as "reparation dyes" to be marketed with entire disregard of their real value; or indirectly, as fabrics dyed at far less than competitive costs. But, fortunately, when viewed from a longer range, the occupation may have a more favorable significance. This disruption to production may be the first step in breaking down the long-standing governmental subsidy and monopolistic organization of the German chemical industry.

Permanent occupation of these plants is, of course, impractical and no one realizes it more than the French. Nor are they laboring under the delusion that there are valuable "dye secrets" that can be carefully dug up and successfully transplanted along the Seine. It is certain, though, that the French will not relinquish control until Germany has made good her default in dye payments.

Labor And Banking

ORGANIZED LABOR has established a number of highly successful banks in recent years, such as that in Cleveland operated by the locomotive engineers. In the past few months this movement has been extended to include New York, the nation's financial capital. These banks are sound and, for the present at least, are well managed. Labor's voyage on the seas of capitalism is attended by a fair breeze and smiling skies.

Whatever changes in weather may occur on this voyage, labor cannot fail, in common with all other travelers, to experience some change, some broadening of outlook, as a result of its trip. Through control of capital, those commanders of labor who decide policy must become familiar with capital's problems. In running a bank successfully, they must put themselves in the place of those who for many years past have been their opponents. The spirit of caution and compromise that so marks the banker may become, at least in part, their spirit. As bankers, the middle path which promotes industrial stability will be more appealing than labor has found it in the past. Co-operation between the elements labor and capital should be easier under these circumstances.

But what this really means for industry is difficult to forecast. It may be that labor eventually hopes so to control capital that labor and capital will be one. Whatever does come of it, it cannot fail to bring some changes, changes worthy of observation and study. And, from our present knowledge of the movement, we believe it will be a beneficial one, deserving of the support of all.

Promoting Mutual Understanding Through Intersectional Meetings

IN ANY organization such as the American Chemical Society with members residing in communities scattered from coast to coast and maintaining viewpoints just as divergent, it is quite natural that there should be occasional misunderstandings. The unfortunate circumstance is that all too frequently, through failure to understand the other fellow's point of view, trivial incidents become magnified until they assume serious proportions. It is not difficult to conceive of a solution. If each member of the society were personally acquainted with every other member, most difficulties could be adjusted quite easily. With a large membership, such an ideal state is, of course, almost impossible to attain, but any activity which leads in that direction is worthy of careful consideration as a means of more closely uniting the profession.

Local section organizations and semi-annual general meetings at strategic points hitherto have provided practically the only means for the members of the American Chemical Society to become better acquainted. These are excellent as far as they go, but they do not satisfy the need completely. Granted that a member knows his entire section, he still has only the local point of view. Very well, let him attend the general meetings and broaden his outlook. A most logical suggestion, but what is the practical outcome? He is bewildered by the sea of strange faces, discouraged at the enormous scale on which operations are conducted and finally for relief turns to friends from his own section. This applies especially to the younger men who are most in need of the benefits to be derived from a widening circle of friends.

What, then, is to be the remedy? Having watched the movement develop, particularly in the Middle West, we unhesitatingly answer "intersectional meetings." The recent gathering at Urbana is typical. In form it

resembled the semi-annual conventions. There were general sessions and four simultaneous group meetings, but there were these essential differences: The group programs were so arranged that all of the papers could be presented adequately and be properly discussed; and proportionately a greater share of time was allotted to social functions. Furthermore with an attendance of 250 or less, the process of getting acquainted with everybody was not a discouraging or an impossible task. Entertainment was furnished by the local members so that there was but little financial strain upon the section acting as host and the total cost of attendance was low enough to attract many younger members who seldom get to the general meetings.

Were the intersectional plan adopted throughout the entire society and a logical rotation of meeting places provided, it would not be long before the members of the sixty-five sections would find a great deal more of common interest and understanding. In our estimation no single activity holds greater possibilities for increasing the solidarity of the American Chemical Society.

A Public Servant Goes Into Industry

ON another page in this issue is the news that one of the government's foremost scientists has resigned to take up an important post in commercial work. Unusual significance attaches to the announcement because of the circumstances as well as the persons involved.

The former chief chemist of the Bureau of Mines is one of the outstanding men of science in America. His work on the rare gases, first as assistant to Sir WILLIAM RAMSAY, and later independently, on radio-activity and the chemical separation of radio-active types of matter, on the atomic weights of krypton and xenon, on the change of thorium emanation to helium, the metallurgy of rare metals, the liquefaction of gases and the properties of matter—these are some of his achievements in pure science. Equally distinguished is his commercial work on the large-scale extraction of radium and, along with others in the bureau, in the practical recovery of helium from natural gas—a process reducing the cost of this pure element from $1,200 a cubic foot to 10 cents and promising a further reduction to 3 or 4 cents.

But like most leaders in research Dr. RICHARD B. MOORE is disposed to bestow greatest credit for these achievements upon those associated with him. Numbered among these is the man who will succeed him at the Bureau of Mines—Dr. SAMUEL C. LIND, a scientist eminently qualified to carry on the work. And, too, it is pleasant to record that the government is thus able to turn to its reserves for men so well fitted to meet such great responsibilities.

Why is it, though, that the Bureau of Mines could not keep this rare talent at work on its own many problems? There has been no ruction or disagreement. Dr. MOORE was singularly happy at his post, and he is not a man of expensive habits. The trouble is that unless a worker in government service has means of his own he cannot hope to provide for old age. In the army and navy provision is made for the retirement of commissioned officers, and even of enlisted men. But civilian salaries, which even before the war were very modest for the competent, have lost considerable of their sustaining power since that time. Reclassification measures have remedied this to some extent, to be sure, but the provisions for retirement are still most niggardly. It is but natural, therefore, that the government should fail to hold the public servant once industry bids for his services.

The Dorr Co. is to be congratulated on this eminent acquisition to its staff. We commiserate Washington on losing Dr. MOORE, but we welcome him as a neighbor with delight and with all good wishes.

The Lunatic Fringe In Science

THERE IS, according to his circulars, a Friend of Man in Pittsburgh, who has sent us through the mails his astro-biochemical chart. From it we learn which of the following twelve salts we should take: *Kali phos., Natrium sulph., Kali mur., Calcara flour., Magnesia phos., Kali sulph., Natrium phos., Calcarea sulph., "Silicea," Calcarea phos., Natrium mur.* and *Ferrum phos.* They are, he says,

> . . . birth salts, as the body is most susceptible to them and anyone can use the number covering their (*sic!*) birthday to good advantage, if ill or not, as they are a scientific food and no medicine, and food is always appropriate. In fact that is the reason hunger really comes, as the body craves these tissue salts, and after all the body is composed of nothing else but these twelve salts together with hydrogen, oxygen and carbon, and any one of these elements falling below their standard brings disorder from same.

For a dollar he will send a "trinity" of salts (for it seems all persons need three of them) and he will make an astrological diagnosis of each case and give free advice as to whether we need other salts than those indicated on the chart as our "food."

This is an example of what THEODORE ROOSEVELT used to call "the lunatic fringe" of science. We might paraphrase the old almanac, and say, "Look out for astrology and all sorts of mystery tricks during the next 10 years!"

For science is ceasing to be didactic. It cannot afford to be. The greatest advances made in chemistry within the last 10 years have been in physics, and the greatest advances in biology have been in chemistry. The borders of all branches of science overlap one another more and more, so that it is becoming difficult to specify the domains of research. Science is becoming an immense, articulated Whole, with chemistry and physics and mathematics everywhere. But that day is not yet at hand and in the process of organization now going on, the lunatic fringes are bound to show themselves all over the great fields.

Let's take another view of the same subject. Nearly every leader of science is becoming modest in his assertions. He is scrupulously careful as to his findings, but he will not commit himself as to their ultimate significance. The Greeks made no distinction such as we do between material and spiritual things, and there is a tendency among thoughtful persons today to follow the Greek rather than the later method, by seeking the spiritual things in material things. This does not mean looking for ghosts in a graveyard by the dark of the moon, but it does mean a far more profound, more philosophical and more spiritually minded study of the nature of energy and of the fundamental things in Nature, as we may approach them with greater enlightenment and understanding.

Some time ago we heard an earnest man of science tell of his experiences in investigating so-called "psychic

phenomena"—not to discover the cause of them, but to satisfy himself whether, among supposedly supernatural occurrences, there was anything which could not be explained by sleight-of-hand or coincidence. He was still uncertain as to what conclusion he might ultimately reach, but he gave his experiences for what they were worth. There followed him a man who makes moving pictures, who has no scientific background or study, but he essayed to reply on behalf of science. Aside from his Billingsgate language and his abuse of everyone who is open minded, there was not an idea, a notion or a thought uttered that was anything more than denial. In other words, here was the scientific man engaged in research in what the movie man declared to be rank superstition. The charge of superstition emanated from ignorance, not from scholarship.

We can't declare any more that "the scientists all say" thus and so. Some of them are thinking big thoughts that the man on the street could not grasp if he tried for a thousand years. And like many of his kind such a person grows angry at what he cannot understand. There are, however, an equal number of other men on the street who have the will to believe but not the gift to understand. They flood over in crowds to the waving emblems along the lunatic fringes. They learn with happy credulity from the gentleman we have quoted or from similar authorities that nitrogen, for instance, is not contained in the human body. And their faith will remain unshaken until pale experience teaches them to the contrary that "*Natrium sulph.*" is a food.

Aluminum Sulphate As a Soil Corrective

FROM California comes the note that clay is rapidly displacing fullers earth for the decolorizing of petroleum distillates. Until recently, fullers earth was considered essential for this purpose, being burned and re-used after maximum adsorption had taken place. The clay now employed as a substitute is treated with acid, washed, filtered, dewatered, calcined and reground. By standardizing the various operations and by using a raw product of uniform and suitable composition, it is said to be possible to manufacture a substitute for fullers earth that possesses all the advantages resulting from technical control of operations.

Often the economic success of a new industry depends on the discovery of an outlet for its byproducts. In this particular process it is aluminum sulphate that is the byproduct, and while investigating other possible uses for it inquiries have been made as to its availability as a corrective of certain conditions in soils. In this connection it is interesting to note that FREDERICK C. COVILLE, of the United States Department of Agriculture, describes in a recently issued bulletin of the American Horticultural Society the results of several tests on the acidification of soil. It is recognized that some forms of plant life thrive only in soil that is acid in reaction; the plants of the heath family are examples. Tests were made whereby it was demonstrated that the treatment of an ordinary alkaline soil with aluminum sulphate resulted in a rapid and satisfactory growth.

It is pointed out that aluminum sulphate, in amount up to ½ lb. per square yard, may be applied to soils of the ordinary type to insure an acid reaction, which is necessary for several species of ornamental plants that otherwise are difficult to cultivate. It is well to remember, of course, that these investigations have not yet passed the experimental stage and that the application is necessarily limited by the small area of acid soils required. Further research is doubtless needed to establish definitely the value of aluminum sulphate as a corrective for soils of various types as well as to demonstrate the effect of aluminum compounds on the different forms of plant growth.

Encouragement Of Intuition

AT THE conclusion of his inaugural address delivered in London the newly elected president of the Institution of Mining and Metallurgy, R. GILMAN BROWN, paid us the graceful compliment of saying that he had been encouraged in his views on the subject of responsibility by an editorial on the education of the intuitions that appeared in a recent issue of *Chem. & Met.* He spoke of the need for an ordered imagination—that quality that suggests a new departure from established practice. It was imagination, we are reminded, that rescued the gold industry by the development of a chemical process of extraction—cyanidation; it was imagination that conceived the copper converter, so superficially similar and yet so fundamentally different from the bessemer converter. "Imagination is one of our prime assets; as it plays around standard practice it alone leads us to question whether an established method is, in fact, a perfect conception. Our profession constantly offers us opportunity for such a question; it affords a daily challenge to the imagination, a challenge which we run a personal risk in accepting, but which we may not in honor decline."

WILLIAM JAMES has said that visions usually constitute our most respectable contributions to the world in which we play our part. Mr. BROWN points out that engineers and technologists are better off than philosophers, for they can link together vision and accomplishment. Realization is the test. Uncertainty as to developments makes us cautious and full of fear. A close scrutiny of reasonings and conclusions follows, "thus arraigning the vision before the bar of detailed knowledge and experience, and making it show cause why it should not be committed as a vagrant dream." This caution, we are reminded, is born of experience and disappointment; it tempers the imagination. It should not be confused with timidity, which is inimical to progress.

This discussion suggests that a line of demarcation, indistinct perhaps, may exist between the great designers of our time and what Mr. BROWN calls the rank and file. What of them? To answer this query, the parable of the talents may be used to crystallize the thought that the less gifted one is in honor bound obligated to make the best of his opportunities. The determining factor must be recognized. "Nor is this beyond our powers if we look to our own approval, which is lasting, rather than to the fugacious praise of our fellows."

The application of science to industry is not alone concerned with facts and figures. Speculation and the exercise of the imagination play an important part in laying the foundation needed as a preliminary to achievement. Mr. BROWN approves of "recent developments in our technical journals: the enlistment of editors who are something more than technicians"; and he welcomes their increasing tendency to discuss the non-technical problems that influence profoundly the progress and development of technology.

Charles A. Rose

Following a significant career of 20 years as engineer and executive is appointed general manager of technical activities for the British America Nickel Corporation.

WHEN the British America Nickel Corporation resumes operations this month, Charles A. Rose will be general manager of technical activities. Twenty years of metallurgical experience as engineer and executive stand behind Mr. Rose as he accepts his new post.

As a young graduate from the University of Nebraska, Mr. Rose began his career with the Alder Creek Gold Mining Co., at Leadville, S. D. Here he outgrew his position as chemist within a short time and was promoted to be superintendent of mill operations. He then became chief chemist for the Boston & Colorado Smelting Co. at Denver, and when the next call came to advance he joined the staff of the American Smelting & Refining Co. as metallurgical engineer.

Then Guggenheim Bros. "discovered" Mr. Rose. So it was that in 1911, after rising in 7 years from comparative obscurity to the front rank of his profession, he severed his Colorado connection to become consulting expert for the Guggenheims and for the Braden Copper Co. Here for the past 12 years Mr. Rose has been active in many fields as assistant to the vice-presidents of both companies. As part of his work in this capacity he has been in charge of the experimental plant in the development of the Chile Exploration Co.

Mr. Rose is a man whose personality inspires confidence. His career justifies the impression. Quiet and thoughtful in manner, sparing of superfluous speech, yet cordial in bearing, he has the happy faculty of creating that atmosphere which marks a successful executive. Combining as he does the attributes of leader and of straight-thinking engineer, it is not hard to understand the reason underlying his advancement to his present position.

At Nickelton, Ont., where the activities of the British America Nickel Corporation are centered, Mr. Rose will manage a $20,000,000 corporation. The magnitude of its operations is revealed by its production, which will include close to 10,000 tons of nickel and 5,000 tons of copper annually. Since 1921, due to the dull market, the plants of the concern have lain idle. Even at the present time the venture of resuming operations is regarded in some quarters as precarious; therefore Mr. Rose faces a problem which is difficult, which will require all of his well-rounded experience, but which he is ideally fitted to meet.

An Extension of the Theory of Gas-Absorption Towers*

Abandoning the Arbitrary Assumptions Involved in the Use of the Logarithmic Mean Formula, a General Analysis of Factors Has Been Made and a Fundamental Relationship Between the Variables Evolved—This Relationship Has Been Checked by a Plant Experiment

By Wallace B. Van Arsdel
Chemical Engineer, The Brown Co., Berlin, N. H.

THERE is substantial agreement among workers in the theory of gas-absorption towers, feed-water coolers and the like that the rate of transfer of the solute from one phase to the other is proportional to the area of contact of the phases and to a potential factor, or "driving force." The constant of proportionality, analogous to that operating for heat-flow in double-pipe coolers, has been determined in a few particular cases described in recent literature.

The only theoretical difficulty to the problem lies in the correct formulation and calculation of the potential factor, and on this point there remains a rather serious divergence of opinion. The formula taken in the present paper was first explicitly stated by Donnan and Masson:[1]

$$\text{Potential factor} = (km - n)$$

where m = conc. of solute in gas-phase, g. per liter,
n = conc. of solute in liquid-phase, g. per liter
$k = \frac{n}{m}$ at equilibrium ("Henry's law" solubility constant).

Another formulation is the one used by Prof. W. K. Lewis[2] and his co-workers[3,4] at the Massachusetts Institute of Technology:

$$\text{Potential factor} = (P - \alpha x)$$

where P = partial pressure of solute in gas-phase, mm. of Hg,
x = concentration solute in liquid phase, mol-fraction,
$\alpha = \frac{P}{x}$ at equilibrium.

The constant α is an *inverse* solubility-function. The two forms of expression for the potential-factor are therefore nearly equivalent, the major difference between them being the occurrence in the latter of an extra factor, α:

$$(P - \alpha x) = \alpha\left(\frac{P}{\alpha} - x\right),$$

equivalent to $\alpha(km - n)$

Very recently some experimental evidence has been presented[5] which indicates clearly that this extra term α should be omitted. If this be done, the remaining difference between the two forms is very small; very careful measurements will be necessary for a judgment between them.

The real difficulty lies in the calculation of the potential factor according to any agreed formulation, since in a counter-current gas-absorption tower, for instance, it varies from point to point. Common practice has been[4,5] to use either the arithmetic or the logarithmic mean of its values at the ends of the transferring system. Now while that is justifiable under certain rather restricted conditions, evidence is here presented which indicates that in many common cases the resulting coefficient is badly in error.

The assumptions on which the logarithmic-mean formula is based are as follows: (*a*) The mass of solute transferred is negligible compared to the total mass of the gas; (*b*) the transfer-coefficient is constant from point to point through the apparatus, and (*c*) the equilibrium solubility-coefficient of the gas, and therefore the temperature of the solvent, is constant from point to point. The arithmetic mean is commonly used when the potentials at the ends are nearly equal, since under those conditions the logarithmic and arithmetic means are nearly the same. Since in practice the above assumptions are by no means always fulfilled, it has seemed to be worth while to investigate the attendant errors and if possible to develop a new type of mean which will fit some of the cases properly excluded by these drastic assumptions.

General Analysis

Certain quantitative relationships between the variables must be established preliminary to the further analysis. It may easily be shown that:

$$V_G = V_G' \frac{d_1 - M_1}{d - m} \qquad (1)$$

where V_G = rate of gas-flow at any point x in the tower, liters per minute,
V_G' = rate of supply of gas to the tower, liters per minute,
d_1 = density of the pure solute-gas at the temperature and total pressure prevailing at the gas-inlet, grams per liter,
d = density of pure solute-gas at the temperature and pressure prevailing at any point x, grams per liter,
M_1 = concentration of solute-gas in gas entering tower, grams per liter,
m = concentration of solute-gas in the gas at point x, grams per liter.

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*Adapted, by the author, from a paper presented at the Richmond, Va., meeting of the American Institute of Chemical Engineers, Dec. 7, 1922.

[1] F. C. Donnan and I. Masson, "Theory of Gas-Scrubbing Towers With Internal Packing," *J. Soc. Chem. Ind.*, vol. 39, pp. 236-41T (1920).

[2] W. K. Lewis, "The Principles of Counter-Current Extraction," *J. Ind. Eng. Chem.*, vol. 8, pp. 825-33 (1916).

[3] W. G. Whitman and J. L. Keats, "Rates of Absorption and Heat Transfer Between Gases and Liquids," *J. Ind. Eng. Chem.*, vol. 14, p. 186 (1922).

[4] R. T. Haslam, "Absorption and Scrubbing Tower Design," Am. Inst. Chem. Engrs., Richmond meeting, December, 1922.

[5] W. B. Van Arsdel, "Theory of Gas Scrubbing Towers," *Chem. & Met.*, vol. 23, pp. 1115-6 (1920).

For the special case of the total change in gas-volume through the tower, a quantity which occurs frequently in subsequent calculations,

$$V_G'' = \frac{d_1 - M_1}{d_2 - M_2} V_G' = \Delta V_G' \qquad (2)$$

where $\Delta = \frac{d_1 - M_1}{d_2 - M_2}$ and V_G'', d_2 and M_2 refer to conditions at the exit point. Formulating a "solute-balance" equation, taking the liquid volume, V_L, as constant, and simplifying,

$$m = \frac{d(f\Delta M_2 + n - N_1)}{f\Delta d_2 + n - N_1} \qquad (3)$$

$$n = f(d_1 - M_1)\left(\frac{m}{d - m} - \frac{M_2}{d_2 - M_2}\right) + N_1 \qquad (4)$$

where $f = \frac{V_G'}{V_L'}$, "flow-ratio,"

n = concentration of solute in the liquid at point x, grams per liter,

N_1 = concentration of solute in the liquid entering the tower, grams per liter.

There is abundant evidence that the solute-transfer coefficient, like the heat transfer coefficient in a double-pipe cooler, is a function of the velocities of flow and temperatures of the fluids, and since we have not restricted the problem to uniform velocities and temperatures, the coefficient itself must vary from point to point. Now the most obviously useful data on such coefficients would refer to invariable velocities and temperatures, since a long tower could be considered as a series of short ones, in each of which the appropriate velocity, temperature and coefficient could be used. Such data must therefore be derived from the results of an actual complex run by correlating with the *mean* velocities and temperatures an *average* value of the coefficient. In a differential section,

$$V_L \delta n = k_1 S \phi k_2 (km - n)\delta x \qquad (5)$$

where k_1 = a constant characteristic of the packing, sq.ft. of surface per cu.ft. gross volume,

S = cross-section area of tower, sq.ft.,

k_2 = the *average* transfer-coefficient for the tower, grams per minute per sq.ft. per gram-per-liter concentration-deficit,

ϕ = a dimensionless multiplier of k_2, averaging unity for the whole tower, ϕk_2 being the actual coefficient for the section.

All available experimental work[4] (including some of our own not yet published) indicates that as between different runs, and to a rough approximation, k_2 varies directly as the gas velocity up to a certain critical flow-ratio, f_c, and directly as the liquid velocity at higher flow-ratios, as suggested diagrammatically by Fig. 1. In addition, k_2 varies inversely as the viscosity of the liquid, η_t, as that is changed by temperature. Moderate change of gas temperature is apparently without effect. Assuming now that for changes in velocity and temperature from point to point in a tower, ϕ varies in the same manner as does k_2 between different runs, four cases may be distinguished by the relation of the actual flow-ratio to the critical flow-ratio, f_c.

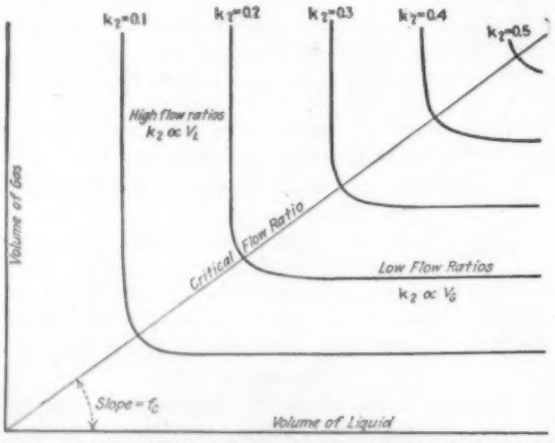


FIG. 1—VARIATION OF TRANSFER-COEFFICIENT WITH CHANGING GAS AND LIQUID FLOW

	$\frac{V_G}{V_L} > f_c$	$\frac{V_G}{V_L} < f_c$
$\frac{V_G}{V_L} > f_c$	Case (a) $\varphi = \frac{V_L \eta_{av}}{V_L \eta_t}$	Case (b) $\varphi = \frac{V_L f_c \eta_{av}}{V_G \eta_t}$
$\frac{V_G}{V_L} < f_c$	Case (c) $\varphi = \frac{V_G \eta_{av}}{V_L f_c \eta_t}$	Case (d) $\varphi = \frac{V_G \eta_{av}}{V_G \eta_t}$

where U_G, U_L and $\eta_{av.}$ are average values of those variables in the given case.

For U_L and $\eta_{av.}$ use the arithmetic mean of the end values. For U_G,

$$U_G = V_G'\left(\frac{1 - \Delta}{\text{Log}_e \frac{d_2 - d_1 + M_1}{\Delta M_2}} + \frac{d_1 - M_1}{d_2}\right)$$

Substituting in equation (5) the value of m from equation (3), and ϕ from this table, simplifying and solving for k_2,

$$(a)\quad k_2 = \frac{V_L}{k_1 h S \eta_{av.}} \int_{N_1}^{N_2} \frac{(f\Delta d_2 + n - N_1)\eta_t}{kd(f\Delta M_2 - N_1) + n(kd - f\Delta d_2 + N_1) - n^2}\delta n \qquad (6)$$

$$(b)\quad k_2 = \frac{U_G}{k_1 h S f_c \eta_{av.}} \int_{N_1}^{N_2} \frac{(f\Delta d_2 + n - N_1)\eta_t}{kd(f\Delta M_2 - N_1) + n(kd - f\Delta d_2 + N_1) - n^2}\delta n \qquad (7)$$

$$(c)\quad k_2 = \frac{V_L f_c}{k_1 h S \eta_{av.}} \int_{N_1}^{N_2} \frac{d\eta_t}{kd(f\Delta M_2 - N_1) + n(kd - f\Delta d_2 + N_1) - n^2}\delta n \qquad (8)$$

$$(d)\quad k_2 = \frac{U_G}{k_1 h S \eta_{av.}} \int_{N_1}^{N_2} \frac{d\eta_t}{kd(f\Delta M_2 - N_1) + n(kd - f\Delta d_2 + N_1) - n^2}\delta n \qquad (9)$$

where h = total height of packed portion of tower, feet. Solution of any of these equations depends on the possibility of evaluating k, d and η_t for given values of n; in general, such relations are empirical and the integration will be performed by a step-by-step summation for the range N_1 to N_2.

SOLUTION. CASE 1

When the change in temperature of the liquid may be considered as predominantly due to the heat of solution of the solute, the liquid-temperature and therefore k and η_t become simple functions of n; for evaluation of d, a rough approximation to T (the gas temperature) is sufficient; the change in T may be assumed proportional to the change in t (the liquid temperature). In practice this is a very important and common condition in such absorption towers as those of, say, SO_2 in water; the heat of solution of the SO_2

is almost always far in excess of any accompanying transfer of sensible heat.

It will be noted that the preceding process sidesteps the necessity of determining any space average of the potential factor. Individual values of the potential factor, however, vary inversely as the quantity within the integral in equation (6), (7), (8) or (9), and may be evaluated by comparison with equation (5)

Solution. Case 2

There is one other case, comparatively unimportant, for which analysis is possible. The restricting assumptions are, (*a*) that transferred sensible heat far exceeds heat developed on absorption of the solute, and (*b*) that changes in the mass and specific heat of the gas are small in comparison with its average mass and specific heat. Summarizing, it may be shown that the liquid temperature then changes from point to point by the exponential law characteristic of heat exchangers, and the solute-concentration by an exactly analogous exponential law; a series of values of $km - n$ may be calculated, and the space-average of these values substituted in the fundamental equation

$$V_L(N_2 - N_1) = k_1 hSk_2(km - n)_{av.} \qquad (10)$$

Removal and Saturation

Two characteristics of tower operation which are nearly always given or required are (*a*) the degree of saturation of the outflowing solution, based on the concentration of gaseous solute entering the tower, and (*b*) the percentage removal of solute from the gas; calling these functions respectively ψ and r,

$$\psi = 100\,\frac{N_2}{k''M_1} \qquad (11)$$

where k'' = solubility constant for conditions at base of tower.

$$r = 100\left(1 - \Delta\,\frac{M_2}{M_1}\right) = 100\,\frac{N_2 - N_1}{fM_1} \qquad (12)$$

For the common case in which $N_1 = 0$,

$$r = \frac{k''}{f}\,\psi \qquad (13)$$

Experimental Check

There is not much experimental material available with which to test the methods of calculation suggested, by actual check of predicted with measured quantities. The following experiment[8] will serve to show, however, the order of magnitude of the differences from the logarithmic or arithmetic mean methods, in a case which is far from being an extreme test.

A wood-stave tower of 28.25 in. internal diameter was fitted up with nine grids, the bottom six each supporting four layers of 6-in. "spiral brick," the next two grids eight layers, and the top grid four layers. Beneath each grid two spirals of lead pipe were so arranged as to collect fair samples of the gas and solution at that point. Dilute SO_2 gas was blown into the base of the tower and water pumped into the top through a rosette head; the former was measured by a standardized orifice-plate, the latter by the decrease in volume in a storage tank. Gas concentrations at the six lower stations were determined by Orsat apparatus and at the three top ones by Reich apparatus. Solution concentrations were determined by iodine titration.

For this style of packing, $k_1 = 18.06$; the height of packing was 23 ft., cross-section area 4.35 sq.ft.; k_1hS = 1,806.5 sq.ft. Fairly high rates of flow were employed (49.8 cu.ft. of gas per minute per sq.ft. of cross-section and 8.03 gal. of water per minute per sq.ft.) and a low-strength gas, about 6 per cent SO_2 by volume. The resulting data, plotted in Fig. 2, were balanced against one another (individual measurements not being precise enough to allow direct calculation of $km - n$), as follows: A fair curve was drawn through the datum points for n, and then using the "conservation of matter" equation (3), m was calculated from n; this curve agreed reasonably well with the plotted points for m. From the smoothed curve for t and that for m, k was determined on the basis of known solubility data. The curve "$km - n$ measured," in Fig. 3, was the result. The coefficient k_2 was determined as follows by taking δn and $km - n$ in 2-ft. steps:

δn	$km - n$	k_2
0.25	0.40	0.55
0.31	0.48	0.57
0.35	0.56	0.55
0.42	0.64	0.57
0.50	0.71	0.62
0.53	0.76	0.61
0.55	0.80	0.60
0.56	0.815	0.60
0.57	0.81	0.61
0.56	0.79	0.62
0.54	0.75	0.63
0.32	0.71	0.65
	Mean	0.60

Now the temperature change of the water in this run was almost exactly accounted for by the heat of solution of SO_2, and the flow ratio was less than f_c for SO_2 absorption at this temperature, 45.25 as against about 50. Equation (9) above was therefore used, with the following pertinent data:

VG' = 6145	M_1 = 0.133	t_1 = 23.2	d_1 = 2.46	k' = 46.3
VL' = 135.7	M_2 = 0.015	t_2 = 24.0	d_2 = 2.57	k'' = 43.1
f = 45.25	N_1 = 0	T_1 = 37	Δ = 0.912	η_1 = 0.93 (relative)
UG = 5750	N_2 = 5.4	T_2 = 23		η_2 = 0.91 (relative)

Coefficient k_2 is found as 0.594, checking closely with the measured mean k_2 and calculated values of $km - n$ are shown on Fig. 3 to agree well with the curve of measured values.

Calculating the logarithmic mean of $km - n$ at the ends of the tower, k_2 by equation (10) is 0.82; by the arithmetic mean it is 0.785. The reason for the difference from the measured value is obvious from Fig.

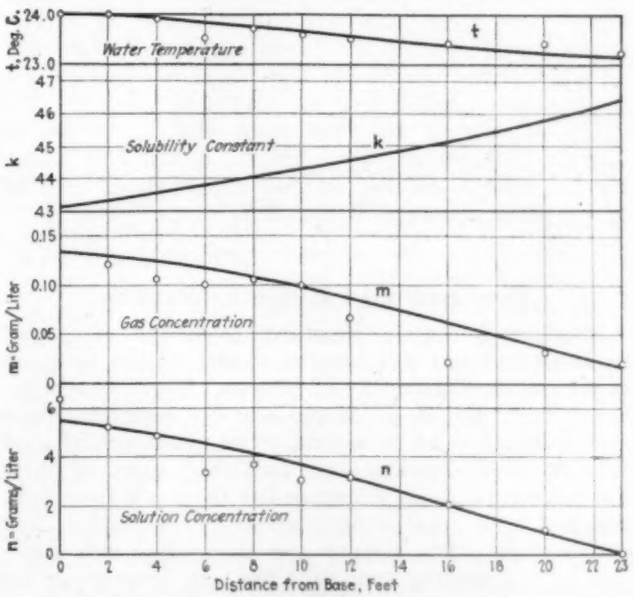


FIG. 2—DATA FROM EXPERIMENTAL ABSORPTION-TOWER SULPHUR DIOXIDE IN WATER

[8] This experiment, with a number of others which cover the general subject of tower performance, will be more fully described in a future communication.

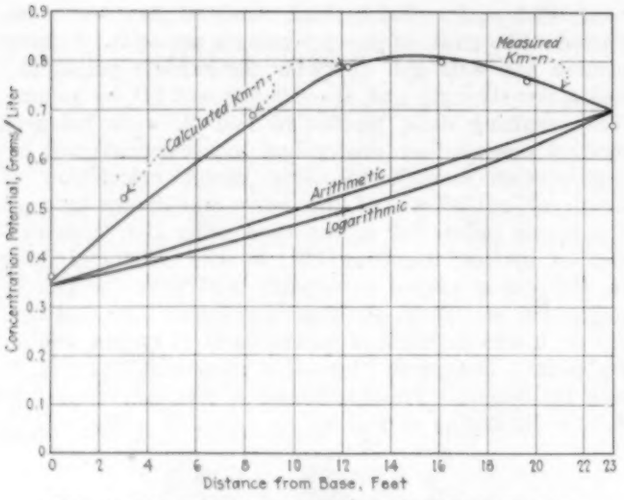


FIG. 3—POTENTIAL FUNCTION—EXPERIMENTAL VS. CALCULATED

3, in which the calculated potentials according to the logarithmic and arithmetic formulas are seen to have entirely different modes of variation than that of the measured potential.

The observation has sometimes been made that even very large errors in the calculation of the coefficient would have no importance practically, provided the test experiments were run under very nearly the same conditions as are to be realized in the projected installation, for then the errors would cancel. This view, however, appears to reduce the coefficient to nothing more than a convenient instrument for interpolation between experimental runs which do not happen quite to fit the desired case. If it be considered what a multiplicity of conditions are possible—volumes of inflowing and outflowing gas and of inflowing liquid, concentration of inflowing gas, temperature of inflowing and outflowing liquid, etc., all variable more or less independently—the desirability of generalizing the data as far as possible will be obvious. For a given type of tower and packing the coefficient should be capable of empirical expression in terms of possibly not more than three independent variables—volumes of inflowing gas and liquid and temperature of inflowing liquid—and a comparatively small number of experiments should open up, by extrapolation, the whole field of possible conditions. But such usage requires at least the accurate calculation of the coefficient.

The experiment described above was carried out in August, 1922, under the supervision of Frank M. Jones, at that time a member of this organization, assisted by six other members of the staff.

Research on Fatigue Resistance

A research into the resistance to fatigue of copper, brass and bronze will become a part of the program of tests at the University of Illinois. It will be remembered that Dr. H. F. Moore and his associates have been engaged in an investigation on endurance of steel for several years, and have published many of their important findings. Finances for the work have been supplied by a member of interested organizations and corporations. The Copper and Brass Research Association is providing funds for the new program on its own material, and will be represented on the advisory board by Messrs. George, Webster and Price.

Light Shed on Oil Shale Distillation

The amount and quality of oil that can be produced from any shale may be made to vary to an important degree by changing the temperature relations existing in the shale charge during destructive distillation, states L. C. Karrick, associate oil shale technologist of the Department of the Interior.

The rate at which the oil is formed from the shale is affected by the rate of heat supply and therefore by the temperature of the shale during its thermal decomposition. The quality of the oil formed may be controlled by alternating the temperature of the shale and therefore the rate of formation of the oil. Variations in the yield and quality of shale oils may be caused by inherent properties of the retort used, but in any event the properties of the crude oil and yield are very largely the result of the extent to which the thermal decomposition has progressed. Recognition of these principles will aid in explaining to a large degree the reasons for the wide variations in oils produced from the same shales by different "processes." These principles also may be applied in the operation of different types of retorts in order that crude oils of a type most profitable to the operator may be produced.

The Bureau of Mines has conducted an extended series of tests in the destructive distillation of oil shales, to determine the wide variations that may be effected in the quality and yield of shale oil by changing the rate and temperature at which the oil is formed. These tests furnished interesting information on the four related points: Yield of oil, quality of oil, temperature required to distill shales, and time required for distillation. Serial 2456, which just has been issued by the Department of the Interior, Bureau of Mines, Washington, D. C., gives this information in detail.

Industrial Research on Lime

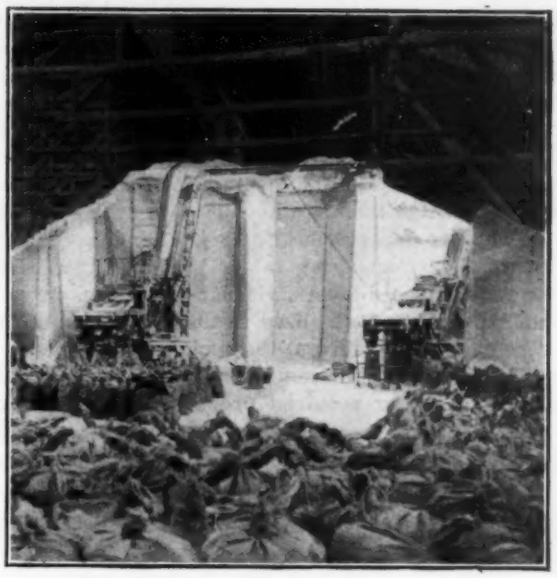
The extent of the use of lime is a matter of general knowledge among technical men. There need be no elaboration of its many uses here. It is interesting, however, to consider some of the research that is under way under the auspices of the National Lime Association. In the first place, the organization has a research laboratory in Washington where the general subject of the fundamental properties of the commercial lime is being studied. Samples of lime from every part of the country are studied in an attempt to correlate such properties as density, porosity, reactivity, rate of settling, etc., with one another and with perhaps other properties not yet definitely determined.

Together with this fundamental investigation, some units of which have already appeared in *Chem & Met.*, the laboratory deals with other problems such as new uses for lime, control of quick-setting lime mortar, aqueous lime paints and such problems as the new users of lime are facing. In addition to this extensive work, a fellowship is maintained at Ohio State University under J. R. Withrow, who is studying the effect of varying conditions of burning on properties of lime. At Massachusetts Institute of Technology, R. T. Haslam is directing an investigation on the chemical systems in lime mortar and lime plaster. At Indiana University, F. C. Mathers is studying lime and mortar and various uses of lime. And finally, W. E. Emley at the Bureau of Standards is co-operating in a study of the construction uses of lime. This is a constructive program which other national associations could well afford to imitiate.

Machinery for Bagging Superphosphate

By Kai Warming

Translated by George Frederick Zimmer



Editor's Note: *This article is most interesting in discussing one of the operating problems of the fertilizer manufacturers abroad. Some phases have only a remote bearing on our own practice. Nevertheless the work is illuminating and well worth careful study.*

MAKERS of superphosphate always find great difficulty in securing the rapid despatch of their large stocks during the busy spring and autumn seasons, because the superphosphate in the stock piles frequently becomes very hard, so that the work of getting it out, breaking it down and packing into bags is a slow and expensive operation which delays the execution of orders.

Drawback of Existing Appliances

The first machines employed for doing this work were set up near the stock pile and the superphosphate was shoveled by one or two men into a bucket elevator, which raised it to the crushing rollers. From these it dropped into bags suspended at the mouth of two chutes; each bag was weighed on leaving the bagger. Although by this method a certain amount of labor was saved in comparison with purely hand work, the machine still had to be fed by hand and was by no means automatic, so that there had to be taken into account the hand labor necessary for breaking down the pile and carrying the superphosphate some distance to the machine. Moreover, work had to be stopped at intervals, in order to shift the machine and weighing apparatus as the men got further into the pile.

The author was therefore led to consider the possibility of devising an apparatus capable of performing all the various operations. When in 1913 he took up the question, he found that it was possible to combine the swinging and digging elevator applied for several years in the warehouses of the German potash manufacturers, with the necessary pulverizers, screens and bagging scales, into a practical and useful labor-saving apparatus for superphosphate handling.

The construction of the machine was planned and carried out in Hamburg in collaboration with the engineer, Paul Burgdorff.

Construction of the Machine

The apparatus consists of a large four-wheeled motor truck driven by an electric motor, current being supplied via a flexible cable. The two large front wheels are driven by separate gearing, so that the truck can turn in a circle of small radius. It can also be run in either direction. The front of the truck carries a bucket elevator, the buckets being provided with cutting edges. The elevator is nearly vertical and is adapted to swing horizontally through an angle of approximately 90 deg. about a large vertical pivot, so that the elevator can cut a trench in the stock pile slightly broader than the overall width of the truck. The swinging and scraping movements of the elevator are imparted by two electric motors, and the change of the swinging direction at the end of each swing is effected automatically on reaching its maximum.

When the machine is set to work the elevator buckets scoop the superphosphate out of the stock pile to a depth of about an inch over an arc corresponding to the radius of the swinging movement, the material being taken out right up to the top of the pile. On the completion of the swing the machine is moved forward a suitable distance without stopping the scooping and swinging movements.

The superphosphate collected by the buckets is discharged onto a screen, and the large lumps are broken in a roll crusher and afterward screened. The sifted product is carried by a shaker and delivered into hoppers at the back of the machine on which the bags are hung; two or three bag scales are arranged underneath the hoppers. As each bag is filled the delivery slide of the hopper is closed and the bag is placed on a conveyor, to be removed, tied and sent off.

Machines of this type are made in several sizes for storehouses, ranging from 10 to 22 ft. in height. The smaller sizes have a capacity of 125 to 150 bags (of 100 kg. each) per hour, while the largest will fill 150 to 180 bags. In the larger machines the hoppers for the fine powdered superphosphate with the bag scales are paced on a separate three-wheeled truck drawn by the motor truck. Furthermore, they have a platform for the operator placed over the shaker conveyor, from where he has a complete view of its workings. Three workmen are needed to operate the machine under the supervision of a foreman, and the latter can learn how to run the apparatus in a few hours.

It should be noted that in digging the superphosphate out with these devices it is taken uniformly from all strata of the pile. This is an advantage from the manu-

*See also article in *Industrial Management* for March 23, 1922, "The Mechanical Handling of Superphosphate," by G. F. Zimmer.

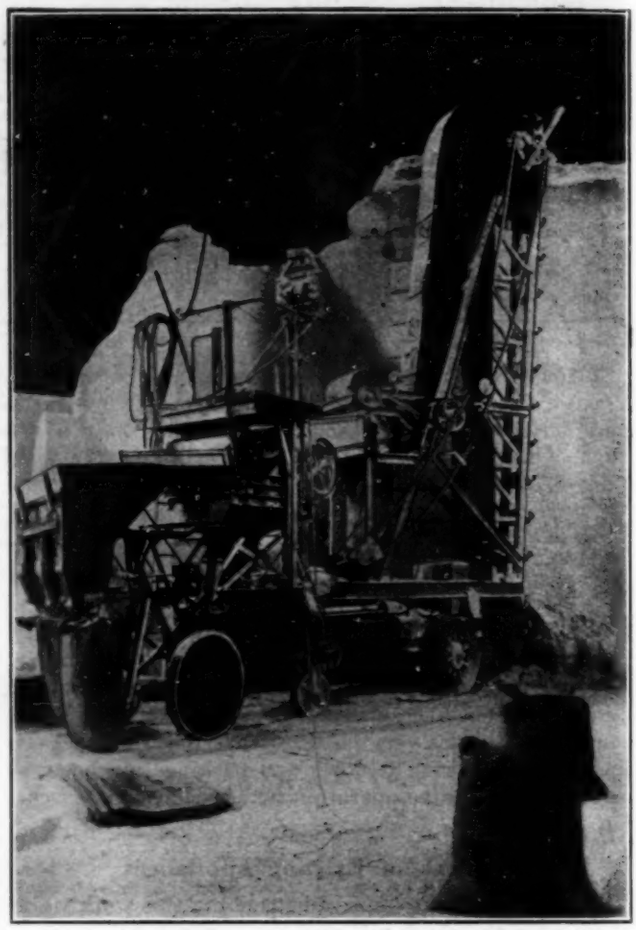
facturers' point of view, since it often happens that some batches of the product do not contain the exact percentage of soluble phosphoric acid desired and consequently have to be covered, in the stock pile, by a layer made with different proportions of ingredients in order to get a true average. In breaking down the pile it is important that these layers of different composition should be thoroughly mixed and a uniform product obtained, which is difficult to do by hand, whereas the machine scoops out the product in the desired proportions, corresponding to the different thicknesses of the superimposed layers. If necessary, this property of the machine can be utilized in the production of blended or compound fertilizers, the various components being superimposed in horizontal layers, so as to get the ingredients in the required proportions, and the pile is taken down in vertical cuts with the machine, thus producing a homogeneous blend.

Comparison of Working Costs

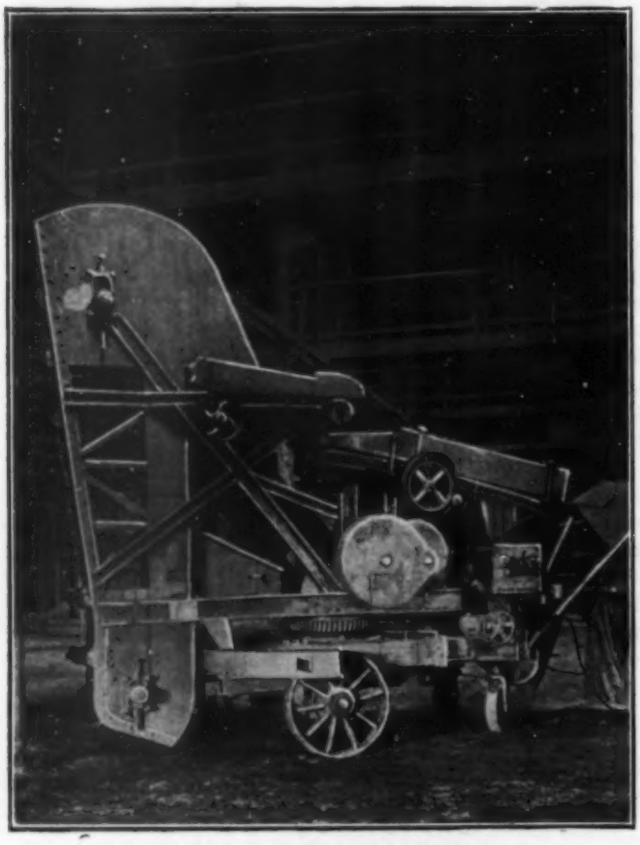
With regard to the relative costs of bagging superphosphate by hand labor and by the machine, the latter works 5 months in the year (the busy season)—that is, for 125 days of 8 hours each, or 1,000 hours in all. The work of bagging, including all the operations necessary for breaking down the pile, screening, crushing, bagging and weighing the superphosphate, tying the bags and loading them on to the wagon, is performed by eight men, at a cost of:

	Francs Per Hr.
Labor, 8 men at 3 francs	24
Motive power, 20 hp. at 0.25 franc	5
Upkeep of machine	5
Total	34
Output: 150 bags per hour, equivalent to	0.23

With hand labor the same eight men would fill only 60 bags per hour, equivalent to a cost of 0.40 franc per bag. The difference is therefore 0.17 franc per bag, or 25.25 francs per hour. In 1,000 hours the profit would be 25,000 francs, which would enable the prime cost of the machine to be written off in a short time.



A MODERN BAGGING MACHINE IN ACTION



ONE OF THE EARLIEST MACHINES

Increasing Output Per Man-Hour

One of the greatest advantages of the machine is that it enables the output per man to be increased from 750 kg. per hour to 1,800 kg., which is a highly valuable factor during the busy season.

Another advantage accruing from the use of these machines is the greater weight of the full sacks. It seems rather peculiar that the machine could give a greater accuracy of weighing than the ordinary balances, but it has been proved that the vibration of the machine and the weighing scales make those more "living" than ordinary standing scales. The accuracy of the weight has proved not to exceed ½ per cent, in either direction, which gives a considerable advantage both to the seller and to the buyer.

The machines can be used for all such materials as "stands" in piles, such as potash salts, sulphate of ammonia and sodium chloride, which are delivered to the sack in fine powder.

These machines have been experimented upon and successively improved in the Danish superphosphate works, where fifteen of them now replace all the former manual labor. It is impossible to prognosticate the future of such a machine, as the factors vary so much in different countries.

AMERICAN OIL CHEMISTS SOCIETY AT HOT SPRINGS

Fourteenth Annual Convention of American Oil Chemists

THE 1923 convention of the American Oil Chemists' Society in Hot Springs, April 30 and May 1, will go down in the annals of the society as one of the most important in its history. There were more than fifty members present, nearly one-fourth of the entire society. Many of the past presidents, and other leaders in the technology and chemistry of fats and oils, took an active part in the proceedings. All the large packers and vegetable oil producers had from one to ten chemists at the meetings. Several of the soap makers were represented, and most of the commercial chemists of the South were on hand.

The program for the 2-day meeting consisted of reports from various standing committees interspersed with papers and addresses on different phases of the manufacture of edible and technical oils.

Election of Officers

The final session of the meeting closed with the election of officers for the coming year. They are as follows: H. B. Battle, Montgomery, Ala., president; H. J. Morrison, Procter & Gamble, Ivorydale, Ohio, vice-president; P. P. Hinterlang, International Refining Co., San Antonio, Tex., second vice-president; J. R. May, Jr., Barrow-Agee Laboratories, Shreveport, La., third vice-president; Thomas B. Caldwell, Law & Co., Wilmington, N. C., secretary-treasurer; Herbert S. Bailey, Southern Cotton Oil Co., Savannah, Ga., editor, and A. W. Putland, Portsmouth Cotton Oil Refining Corporation, Portsmouth, Va., assistant editor.

These officers constitute the governing committee, the personnel of which is somewhat changed this year owing to the addition of two vice-presidents, the editor and assistant editor as elective officers. Heretofore the committee has consisted of the president, vice-president, secretary-treasurer and the four most recent presidents of the society.

Banquet

Tuesday night, after all the business of the convention was well out of the way, the members with their wives and guests enjoyed a most delightful banquet in the private dining room of the Eastman Hotel. David Wesson as toastmater staged several unique stunts, such as having the waiters fill all the glasses, after the guests were assembled, with perfectly clear water, which immediately turned into delicious *looking* wine. He was suspected of having used a phenolax tablet to perform this classic miracle.

This year for the first time the society had as banquet guests and speakers both the president and the vice-president of the Interstate Cottonseed Crushers' Association.

With the consignment of the loving cup once more to the custody of Mr. Battle, the forteenth annual convention of the American Oil Chemists' Society was brought to a fitting climax.

L. M. Tolman's Presidential Address

The society, in the opinion of L. M. Tolman, retiring president, has during the past 2 years become much more representative of the entire field of fats and oils than under its old name of Cotton Products Analysts. While among its members are to be found nearly all the chemists of the great American edible oil industry, it must continue its efforts to attract those interested in the paint, varnish, soap and other technical oils. He advised against joint meetings with the American Chemical Society, pointing out that at these meetings it would be difficult for those interested in a single field of chemistry to concentrate on their own specific problems.

The greatest contribution the society can make toward the advancement of this country's position in the world's oil industries is, in Dr. Tolman's opinion, along the lines of improvement in methods of analysis. Much has been accomplished by the Smalley Foundation work to perfect the procedures and technique in the determinations of oil and ammonia. The collaborative work of the society should now be extended to cover more thoroughly other analytical methods and increase the proficiency of its members in all lines of laboratory control.

Bleaching Processes Discussed

The problem of how best to bleach an edible oil is today receiving perhaps more attention than any other single phase of the general refining process.

William Kelly of the Filtrol Co. of California read a paper on the bleaching earth Filtrol. Its source is a deposit of impure silica on the edge of Death Valley, hence it is sometimes known as Death Valley clay. The raw material is refined in Los Angeles to a finished product which is pure silica with about 7 per cent of aluminum silicate. It is claimed that besides its ability to absorb coloring matters from vegetable and mineral oils, Filtrol will remove sulphuric acid, free sulphur compounds and moisture. This makes it especially suited to the bleaching of lubricating oils. Since with vegetable oils this earth can be used at a much lower temperature than is commonly employed with fullers earth, there is no tendency for the oils to oxidize or become rancid. To the soap makers this new bleach would be of especial interest if the laboratory results can be duplicated in the factor. Crude coconut and

soya bean oils bleached with it yield soap which will not darken.

In addition to fullers earths most refiners are now using chars or activated carbons in their bleaches. A. A. Jackson, who is with the Darco Sales Corporation, after discussing briefly the development of carbons for the removal of coloring matter from sugars, sirups, glycerines, oils and similar products, described the process by which Darco is made and told of its various uses. He said that while wood chars are good absorbents for gases, as a rule they did not possess any great decolorizing properties.

The decolorizing powers of a carbon may be increased by simply heating it out of contact with air; by impregnating the raw material or char with certain chemicals, heating and then removing the impregnating agent, or by simply heating the raw material in a current of steam or gas to prevent too rapid oxidation during furnacing.

Many materials have been used for the production of so-called activated chars: grasses, hulls, leathers, blood, hoofs, horns, paper mill waste and lignite. It is this latter substance which is the basis of Darco carbon. The plant is located in the Texas lignite field at Marshall. There the raw material as mined is crushed, and furnaced by a special process which is claimed to yield a very active carbon. The color absorptive power is then further increased to "an established point of standardization" by the extraction of impurities with solvents.

In the use of chars for bleaching vegetable oils, it is customary to mix them with fullers earth. Darco, said Mr. Jackson, works admirably in such combinations, but can also be used to advantage by itself. He believed that shortly such chars would largely replace all fullers earth bleaches in the edible oil business.

Vacuum Refining and Super-Deodorization

Two papers covering refining under vacuum instead of at atmospheric pressure were presented on Tuesday. This is a comparatively new idea to the American refiner and these communications aroused considerable interest. Louis C. Whiton, representing the Bataille process, described methods and apparatus not only for neutralizing the free fatty acids but for bleaching and deodorizing under vacuum. He claimed for his refining process that the soap (foots) being dehydrated would settle more readily and with less occlusion of oil than in the present open kettle procedure. Also that one could get a much more intimate contact between the lye and oil without the danger of emulsion formation. This meant the refined oil was of exceptionally low acid content and that the usual saponification loss was somewhat reduced. Bataille recommends a horizontal instead of vertical refining kettle. After neutralization with a fairly strong lye and the evaporation of the water, which takes only about 2 hours, the batch is discharged into a large settling tank. Thus the vacuum apparatus need not be very large (10,000 lb. capacity), as the batches are put through it about ten times as fast as in present practice.

Mr. Whiton believes that there is an advantage to be gained in bleaching with fullers earth in vacuum. Operating data obtained over a period of years in Europe indicate that the loss due to absorption of oil in the bleaching earths or chars is less under vacuum, as only 40 to 60 per cent of the usual amounts of these bleaches is needed. A possible explanation is that at reduced pressure all the moisture which is known to interfere with color absorption is removed from both oil and earth.

Super-deodorization is the term applied by Mr. Whiton to the process of deodorizing at extremely high vacuum and comparatively low temperature. Since the amount of objectionable odors and flavors removed by a given weight of steam is proportional to its volume, the higher the vacuum the more work it will do. The actual daily operating vacuum of the Bataille super-deodorizer is 29.7 in., with a 30-in. barometer. Under this small pressure it is estimated that steam has a volume six times as large as at the usual 28.5-in. vacuum. This high vacuum is obtained in practice by stepping up a high, primary vacuum with a special type of steam ejector. With cottonseed oil the deodorization is carried on at 295 deg. F. and requires from 1 to 2½ hours. Such plants have been in operation abroad for nearly 9 years and more than 100 are in regular use. It is claimed that in these the quality of the finished oil is superior to those obtained where lower vacuum is used, as the Bataille system removes some substances that are not volatile at a higher pressure than is maintained in the "super-deodorizer."

Francis M. Turner, chemical engineer with T. Shriver & Co., in his paper, which was illustrated with many interesting samples, spoke of the dealbuminizing process he is developing for the treatment of crude vegetable oils, and his procedure for vacuum refining. In the dealbuminizing treatment he removes the so-called "gums" or "albumins" by a simple process, the details of which were not disclosed, and then bleaches without refining. A sample of coconut oil exhibited was free from rancidity, although it was 2 years old and had never been refined, merely dealbuminized. Dr. Turner's results with vacuum refining were similar to those obtained by the Bataille process. The soapstocks he showed were hard and dry and nearly free from the disagreeable odor common to most soapstock.

Chemical Constituents of Cottonseed Oil

Two of the most instructive papers, "chemically speaking," were those by George S. Jamieson of the U. S. Bureau of Chemistry. One of the problems his laboratory has been investigating is the composition of the free fatty acids of cottonseed oil. He concludes that the acids are set free by hydrolysis in practically the same proportion as they occur as glycerides in the oils.

Even more valuable were the results reported by Dr. Jamieson on "Some of the Non-Glyceride Constituents of Crude Cottonseed Oil." Practically all of the complex chemical bodies forming the "gums" which gradually settle out of filtered crude cottonseed oil on long standing have now been identified. This gum, which is physically similar to the "foots" of linseed oil, will separate more rapidly if moisture is present in the oil, and changes in temperature also hasten its sedimentation.

At the request of the editor, a special committee was appointed to consider the feasibility of publishing a quarterly to be known as the *Journal of the American Oil Chemists' Society*. This committee made a tentative report stating that it believed it would be possible to finance such a quarterly and hoped to begin issuing with 1924.

The Rarer Metals

A Symposium Held at the Recent Meeting of the American Electrochemical Society

THE outstanding technical feature of the recent New York meeting of the American Electrochemical Society was the session on the "Rarer Metals" conducted by F. M. Becket. The opening address was made by Prof. Charles James of New Hampshire College, who has gained a world-wide reputation through his remarkable researches on the rarer metals. Nótwithstanding the fact that much time has been spent searching for methods for detecting the rare elements, in many cases good methods of separation are completely lacking. Present means of separating columbium from tantalum are very unsatisfactory. So far as quantitative analysis is concerned, the greatest problem is found in the case of the cerium and yttrium groups of metals. The separation of the two groups is an extremely tedious matter which is rarely carried out.

When Is an Element Useless?

When an element is condemned as being useless, it is evident that its characteristic properties are deeply hidden. Germanium, which once seemed useless, is attracting much attention in the medical world, because of its action on the blood. The element occurs in argyrodite and canfieldite and to a minute extent in some zinc ores. A very important discovery is a copper sulphide ore of Africa containing as much as 7 per cent germanium. Work at New Hampshire College indicates that the metal can be easily extracted in an exceedingly pure condition. There is therefore a possibility that it will become sufficiently plentiful that its effect upon metals and alloys may be determined. Copper with 5 per cent Ge is a pale gold-colored alloy.

Thulium oxide on careful heating gives a beautiful carmine-colored light, which changes as the temperature is raised, becoming yellow and then almost white. The reduction of beryllium compounds presents very great difficulties. An elaborate investigation is now under way. It is important to develop a simple method for the quantitative determination of Be; such knowledge would allow us to study solubility curves and alloys with rapidity. Indium occurs more commonly than gallium in certain zinc products. Some flue dusts have shown as much as 0.5 per cent of gallium. Many other elements such as lanthanum, dysprosium, holmium and yttrium are being carefully investigated and no doubt the day is not far off when elements at present of little commercial importance will occupy a field of usefulness such as has been achieved by thorium, tungsten and vanadium.

"The Metallurgy of Lead Vanadates" was the title of the paper presented by Dr. Will Baughman of Los Angeles, Calif. He reviewed the various methods of treatment of lead vanadates and then outlined in detail his own method, which has been tried out on the Black Butte ores. In the electrolytic separation, which is an important step in the process, a mercury cathode is used. Tungsten, molybdenum and chromium pass into the amalgam and vanadium separates out as oxide. Separation can also be affected by the volatilization method: Hydrogen is passed over the mixed oxides of vanadium, tungsten and chromium heated to 1,400 deg. C. The vanadium pentoxide is reduced to the trioxide and this is readily distilled off, leaving W, Cr and Ti behind. In the preparation of metallic vanadium Dr. Baughman found lithium to be the best reducing agent. A metal containing 95 to 97 per cent V is easily obtained. Dr. Baughman's paper was discussed by Messrs. Saklatwalla, Fink and Arsem. Mr. Arsem said that the melting point of vanadium was 1,650 deg. C.

C. W. Drury, professor of metallurgical research, Queen's University, referred to the important deposit of cobalt at Cobalt, Canada, which supplies about 90 per cent of the world's demand. The Canadian ore contains about 5 per cent Co, 4 per cent Ni, 10 per cent Fe, 14 per cent As, 1 per cent Cu, 7 per cent S and 20 per cent SiO_2. The process of producing pure cobalt oxide and metal is a long and tedious one. In the production of 1 lb. of cobalt 3,000 lb. of solution is handled. Cobalt is used chiefly in the manufacture of stellite and as one of the main constituents of permanent magnets. The addition of cobalt permits magnets to be made of less than half the weight of those made of ordinary tungsten magnet steel. The demand for cobalt is greater than the supply. E. O. Benjamin referred to the cobalt plating of the iron anode in the electrolytic oxygen cell. He found that Ni-plated anodes were better than those that were cobalt-plated. Messrs. Fink and Ralston pointed out that a very good separation of cobalt and nickel is possible by electrolysis. Kenneth S. Guiterman of New York referred to the production of appreciable quantities of cobalt and nickel as byproducts in the smelting and refining of copper. The A. S. & R. had accumulated large tonnages of cobalt-nickel speiss which locked up appreciable amounts of gold and silver. The Guiterman process consists in sulphating the speiss, followed by a solution thereof in water. After the preliminary removal of Fe, As, Cu, etc., NaCl is added and the solution electrolyzed between graphite anode and copper cathodes. Cobalt is precipitated out of solution as a hydrated oxide and the nickel collects on the cathode. The efficiency of the separation is about 98 per cent.

The G. E. Chromizing Process

A simple and efficient method of applying a protective coating of chromium to iron and steel was described by F. C. Kelley of the General Electric Co. The process consists of packing the material to be treated into a powdered mixture of alumina and chromium. The amount of each material used in the mixture is 45 per cent of alumina and 55 per cent of chromium by weight. The material is usually packed into a tube of iron, and then heated at 1,300 to 1,400 deg. C. in hydrogen, in vacuum or in some neutral atmosphere, for lengths of time depending upon the penetration and concentration of chromium desired. The furnaces used for this work consist of alundum tubes wound with molybdenum wire as a heating unit. These tubes are placed in a suitable furnace casing and surrounded with alumina powder, which acts as a heat-insulating material. In chromizing it is necessary to have powdered chromium of at least 95 per cent purity, for chromizing iron which is intended to withstand corrosion. Powdered Al_2O_3 is necessary as a diluting agent, and to prevent excess sintering of the powdered material at high temperatures. It is also necessary to have pure hydrogen, free from moisture and oxygen.

Discussing Mr. Kelley's paper Prof. John Johnston of Yale pointed out that the citation from Spring made by Mr. Kelley—namely, that "alloys might be produced by compression of their constituent metals in a fine state of division"—is without foundation. Johnston had

carefully investigated this matter and found that compression alone does not result in the production of true alloys. Colin G. Fink questioned whether satisfactory results were commercially possible if the chromizing process were carried out in the absence of hydrogen, he regarding hydrogen as a most essential "flux" for this process. L. O. Hart of the Driver Harris Co. suggested that it might be a good deal cheaper to use chromium-iron alloys in place of a chromized surface metal, great improvements having been made in the production of high-percentage chromium-iron alloys. H. K. Richardson of the Westinghouse company referred to his experiments on electroplating chromium on ferronickel wire for lamp seals and said that decidedly below 1,200 deg. C. penetration of the Cr into the alloy below was clearly discernible, the Cr entering the ferronickel lattice.

What Does Metallic Uranium Look Like?

"The Preparation of Metallic Uranium" was investigated by R. W. Moore of Schenectady. Starting out with the tetrachloride of uranium, this was reduced by metallic sodium and a finely powdered uranium metal obtained. The powder was compressed into pellets and these were melted with an arc in atmosphere of argon. The fused metal had the appearance of polished iron. Some buttons could be rolled cold from a thickness of about 5 mm. to small sheets about 0.375 mm. thick.

Dr. Moore's paper drew forth animated discussion. Charles A. Doremus of New York pointed out that the apparatus used by Moore resembles very closely the apparatus used by Robert Hare in 1842. J. W. Marden and H. C. Rentschler of the Westinghouse Research Laboratories have likewise for some time been studying the preparation of metallic uranium. They did not consider the chloride-sodium reduction method reliable and furthermore their metal is not brown, but looks very much like molybdenum.

James A. Holladay and Thomas R. Cunningham gave an account of the "Determination of Uranium by Means of Cupferron. The method was developed at the Union Carbide & Carbon Research Laboratories.

Hugh S. Cooper of the Kemet Laboratories, Cleveland, reported upon the very interesting results he has obtained in the "Preparation of Fused Zirconium." $ZrCl_4$ was reduced with metallic sodium and the product obtained contained 99.28 per cent Zr, the impurities being Fe, Ti and Si. The melting point of this material was determined in the Arsem furnace and found to be about 2,800 deg. C. Alloys of 60 per cent Zr with tin were found to be exceedingly pyrophoric. Zr forms alloys with Ni, Cu, Au, Al, Mg and W. Dr. Cooper showed a number of samples of new alloys.

In the discussion, J. W. Marden of Bloomfield, N. J., said that according to his experience it was impossible to avoid contamination when the zirconium was heated in the Arsem furnace. Accordingly, in recent work at the Westinghouse laboratories a high-frequency, high-vacuum induction furnace was used. The method of analysis for Zr is very difficult and very deceptive results may be obtained. The melting point given by Mr. Cooper corresponds more nearly to that of the oxide or carbide, but not to that of the metal, which is much lower. Dr. Fink felt that the Arsem furnace was one of the most convenient high-temperature laboratory furnaces made, but that time and again experimenters were using it for tests for which the furnace was not intended. There is always an appreciable residual atmosphere of CH_4, CO and probably other gases present which may affect results very markedly. He referred to his determination of the melting point of cobalt; in the Arsem furnace it was 1,490 deg. C. and in his high-temperature hydrogen furnace, 1,610 deg. C. A mere trace of carbon will depress the melting point over a hundred degrees.

A Brilliant Research on Zirconium Steel

F. M. Becket's paper on "Some Effects of Zirconium on Steel" was probably the most important contribution of the session. The Electro Metallurgical Co. has been conducting a series of scientific tests on the addition of zirconium to the steel bath and some remarkable results have so far been obtained. Zr has a greater affinity for oxygen than Si. When Zr is added to steel in excess of approximately 0.15 per cent, this element assures a new rôle by chemically combining with sulphur to form an acid-insoluble compound not detected by ordinary analysis. Zr has a greater affinity for S than Mn. The beneficial effect of small additions of Zr is strikingly demonstrated in the case of heat-treated ordinary carbon steels. The physical characteristics of the product approached those of the highest grade, heat-treated alloy steels. Zr is usually added as a silicon-zirconium alloy. Dr. Becket's paper was discussed at length by E. F. Cone, H. W. Gillett and Dr. St. John.

The report of the detailed investigation on "Treating Steels With U, B, Ti, Zr, Ce and Mo" carried out at the Bureau of Mines, Ithaca, was submitted by H. W. Gillett and E. L. Mack. It was found that Mo has a consistantly beneficial effect. In the types of steel in which the other elements were used they were either of slight effect one way or the other, or decidedly harmful. Mo is a potent alloying element. Prof. Bradley Stoughton discussed the development of super-steels and the elimination of P, S and gases. He also suggested that the elements Gillett and Mack investigated ought to be tried out as additions to pure electrolytic iron. C. P. Madsen, E. F. Cone, C. A. Doremus, Jerome Alexander and Dr. St. John also joined the discussion.

A scholarly discourse on the "Inherent Effect of Alloying Elements on Steel" was delivered by B. D. Saklatwalla of the Vanadium Corporation. He laid stress on the importance of studying the physical conditions, and their alterations by alloying elements, during the period of solidification. Too little attention has been paid to the changes in surface tension of the steel.

The three last papers of the symposium dealt with the physics and chemistry of platinum and its associated metals. Robert P. Neville of the Bureau of Standards described the "Preparation of Platinum and of Platinum-Rhodium Alloy for Thermocouples." The melting was carried out in a Northrup high-frequency furnace in crucibles of lime and thoria. H. K. Richardson referred to his thoria crucibles as being made by regular ceramic methods. Fred E. Carter of Baker & Co. did not consider the metal made in the high-frequency furnace superior to the best grades on the market.

Edward Wichers and Louis Jordan told of the "Investigations on Platinum Metals" carried out at the Bureau of Standards," a very comprehensive study.

Fred E. Carter of Newark, N. J., presented a report of his experiences with the "Metals of the Platinum Group." The tendency to absorb gases is very marked and in consequence difficulties arise during melting. The addition of iridium to platinum raises considerably the temperature required for annealing.

Hardness and Hardening

A Synopsis of Dr. Walter Rosenhain's Lecture, Given at Various Localities During His Recent American Tour—Parallel Phenomena Found in Many Alloy Systems Help Explain Why Steel Is Hard

A CHILD finds whether something is hard or soft by poking his thumb into it, or scratching it with his fingernails. If it dents or scratches it is soft; if it does not, it is hard. We grown-up children do something much like this, only we use a steel ball instead of a thumb, a sharp jewel instead of a nail and a power press for muscle.

Such methods give only a relative idea of hardness. Furthermore, it should be remembered that a pile of sand or brick is extremely hard if one is thrown against it, yet is quite soft toward piecemeal removal. It follows, therefore, that the scale of hardness varies with the tool used.

With these considerations in view, Dr. Rosenhain defined hardness of a material as the power of resisting the local displacement of portions of its substance; to the degree of strength, cohesion or resistance it offers to piecemeal removal. It follows that this property is allied to the unit stress which can be borne without permanent deformation.

How does a material resist applied forces? We here may divide substances into two general classes, viz., those capable and those incapable of plastic deformation under stress. Metals, especially most pure metals, fall into the first category, so consideration must now be given to the nature of plastic deformation. We are also enabled to push our definition of hardness one step further, by noting that it is a function of the resistance a metal offers to plastic deformation.

It is perhaps trite to repeat that plastic deformation in metal occurs by means of block movements within the individual crystals of the aggregate. As a matter of fact elongated grains in severely worked metal are still essentially crystalline—probably highly fragmented, but consisting of crystalline particles. For instance, if a piece of pure iron be squeezed in a vise while constantly under microscopic examination, its smoothed surface will acquire permanent marks, roughly parallel to one another within individual crystals, but in different directions in adjoining ones. Further stress multiplies these lines and develops second or third sets of intersecting conjugate markings. The nature of these markings is shown in Fig. 1. The crystal has been broken into blocks which move slightly past each other and then regain their rigidity. The top surfaces still reflect vertical light directly back into the microscope and appear white; the inclined slips deflect vertical light to the right and appear dark. An exact negative of the view can of course be had by side illumination from a source located in the direction of *A*. Furthermore, a surface such as this can be heavily coated with a protective copper plate, sectioned at 90 deg. and the steps and changes in level can thus be actually observed.

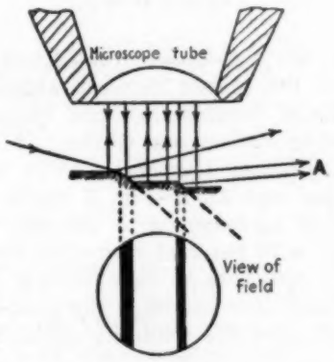


FIG. 1—DIAGRAM ILLUSTRATING THE OPTICAL BEHAVIOR OF SLIP BANDS[1]

[1]Reproduced from Fig. 103, "Introduction to Physical Metallurgy," by Walter Rosenhain.

Crystallinity Confers Ductility

It is not so often appreciated, however, that it is the crystalline character of metals which confers the property of ductility and plasticity—that permits the phenomenon of slip. X-ray investigation has confirmed the belief that the atoms in crystals are arranged in a regular geometric order, repeating itself perfectly in the adjacent infinitesimal elements of the crystal. Very ductile metals like iron and gold crystallize in a cubic arrangement; more brittle zinc builds up a space lattice like a nest of hexagonal parallelopipeds.

Atoms are strongly held to position in these lattices by balanced forces, possibly of electrical nature, exerted by and upon all their surrounding neighbors. In fact the atoms are so strongly held that they are capable of only a relatively small displacement by outside forces. Within this range their displacement varies as the imposed force—they act in an elastic manner. Larger stresses break these interatomic bonds temporarily, and a crystal block slides along some principal cleavage plane, the atoms on each side momentarily making a change of partners.

For practical purposes the main cleavage plane of the cubic system (the 1-1-1 or octahedral plane of the crystallographer) may be regarded as quite smooth—the atoms are spaced along it in a perfectly regular manner in all directions, and they can change partners with considerable facility. In other planes, and along principal planes of more complex crystals, the atomic spacing is not so regular, and an atom once free cannot always find a new partner unless the movement stops after a well-defined interval.

Thus it is that we are naturally led to the conclusion that ease of slip, or ductility, depends upon atomic regularity in the crystal. Conversely, slight irregularities in spacing, or the occurrence of lumps or humps on the gliding planes, decrease the plasticity

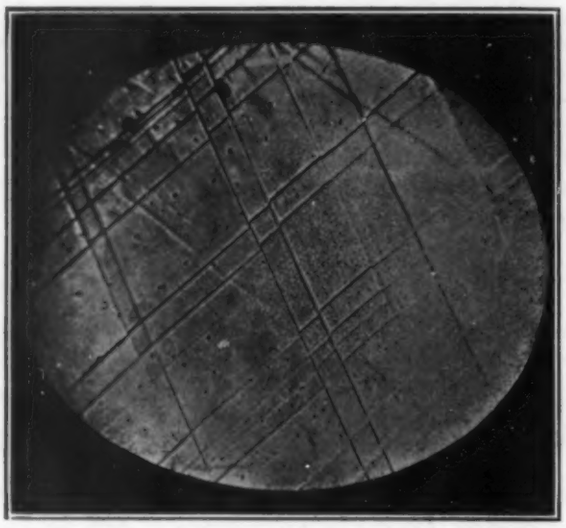


FIG. 2—SLIPS IN A CRYSTAL OF OVERSTRAINED LEAD[3]. × 1,000

and increase the force required to start slip—that is to say, increase hardness. It follows directly that slip is inconceivable in amorphous (non-crystalline) material; in such substances actual fracture is necessary to bring about sudden movement.

From these considerations we arrive at the statement that hardness depends upon the smoothness and extent of the available slip planes. From this viewpoint it becomes apparent that ductile metals like iron, aluminum and copper can be hardened in various ways:

First, by producing a multitude of humps on the main crystallographic planes. Dr. Rosenhain has shown in his lecture before the Institute of Metals[3] that this always occurs when two metals enter into solid solution. "Stranger atoms" replace their hosts at the latters' position in the space lattice, but since the balance of interatomic forces is disturbed, the neighbors are slightly displaced. This roughens the slip planes, consequently solid solutions are harder than the constituent metals, often very materially so.

In the second place, a ductile metal can be hardened by fragmenting the large crystals. This is the principal effect of cold work. Although in purest metal it might theoretically be possible for a slipped crystal to remain homogeneous, in practice considerable derangement is always produced at the surfaces of slip. Some atoms always fail to find new partners, and some are more or less uneasy in their new surroundings, at least for some time. Such effects result in an upset in the space lattice, which naturally will be a zone offering considerable resistance to an incipient slip along an intersecting direction, and even greater resistance to second movement on the same plane. Successively infiltering amorphous layers therefore "fault" the crystal in many directions (Fig. 2), increase the resistance to stress; finally the metal reaches a state where ductility is exhausted and it becomes brittle, even though still consisting principally of an assemblage of crystalline fragments.

Third, hardening can be effected by increasing the amount of amorphous material at the crystalline boundaries. Where one atomic orientation meets another there must be an interface (which may be several hundred or perhaps only a few atoms thick) where the space lattice is a compromise between the two. These regions increase hardness of the metal by roughening at the ends of potential slip planes. Considerable end support is also given by adjacent grains. Furthermore, deformation transmitted across a boundary must change direction. These factors are not marked unless the grain size is very small—then they become very important indeed.

Finally, and most important, metal may be hardened by distributing finely divided hard particles throughout the crystal. This can be done by alloying a substance which is somewhat more soluble in the metal at elevated temperatures than at room temperatures. On cooling the then insoluble material precipitates as very fine and highly dispersed particles; if the cooling is at a proper rate these particles cannot coagulate to any extent, and the result is that the crystalline lattice of the mother material is not only interrupted by these particles, but itself is largely in an amorphous condition following the disruption of the lattice necessary to eject the insoluble material. In fact, the latter factor (amorphitization of the solvent material) is the principal reason for the intense hardening possible by this method, in Dr. Rosenhain's opinion.

Three alloy systems were cited by the lecturer to show the remarkable similarity of the hardening phe-

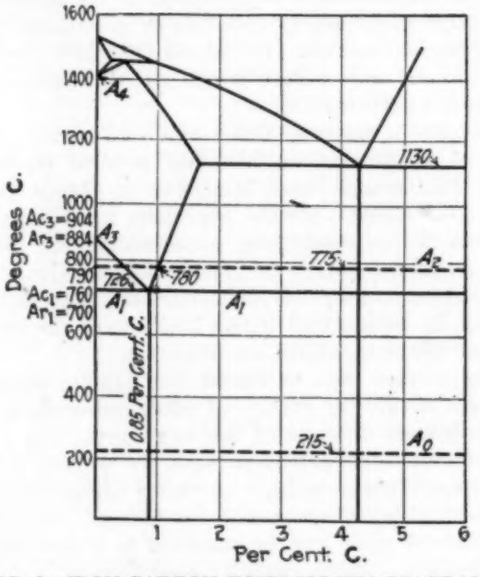


FIG. 3—IRON-CARBON EQUILIBRIUM DIAGRAM, AFTER HOWE

nomena—viz., the well-known iron-carbon series, which includes steel, the system between aluminum and the Compound Mg_2Si (duralumin), and the eluminum-zinc alloys studied by Hanson and Gaylor.[4] Figs. 3, 4 and 5 show the equilibrium diagrams. Draw a vertical line through 82 per cent Zn in Fig. 5 (point *F*) and note how the β field corresponds to the austenitic field in steel, and how a 79 per cent zinc alloy would develop a truly pearlitic structure on slow cooling. It is obvious that the inclined lines bounding the solid solution fields merely indicate how the solubility varies with the temperature.

In all these alloys a quench at a rapid rate from a correct temperature to a sufficiently low temperature will retain the solid solution practically intact, but in

[3]Reproduced from Fig. 100, "Introduction to Physical Metallurgy," by Walter Rosenhain.
Chem. & Met. March 7, 1923, p. 442.

[4]"A Further Study of the Alloys of Aluminum and Zinc," by D. Hanson and Marie L. V. Gayler, *J. Inst. Metals*, 1922.

an unstable condition, and the metal, while much harder than in the pure state, is much softer than it can be made. The metal may be said to be in the austenitic state. It is a mere detail that the Al:Zn alloy must be quenched and held in liquid air to retain austenite. If the speed of cooling be slightly lower, or if the drastically quenched metal be warmed somewhat, it becomes very hard. Either operation gives the necessary time and atomic mobility so that the unstable solid solution may break down into two phases—viz., minute crystals of a new phase and a disarranged lattice of the original. This condition (known in steel as martensite) will give maximum hardness because offering maximum resistance to slip; gliding planes are almost absent. Again, it is only an incidental fact that the tempering or drawing temperature of duralumin is at or lower than the atmospheric, therefore quenched duralumin "ages" or hardens spontaneously for several days.

Slower cooling or higher tempering will allow the metal to more nearly approach its new equilibrium; the crystals of the second phase (Fe_3C in steel, Mg_2Si in duralumin, and β solution in Al:Zn alloys) will grow in size, and the mass of the material (ferrite in steel, aluminum in duralumin and α solution in Al:Zn alloys) will reorganize its lattice and accumulate into larger crystals. With this the possibility of slip returns, the metal loses hardness slightly, and the microscopic appearance known as troostite may be found. It happens that Al:Zn alloys, quenched in liquid air and warmed to room temperature, temper (that is, separate into two phases) so fast that the latent heat liberated by the chemical and physical reactions will warm them so they cannot be handled with comfort within a few minutes. This phenomenon is a beautiful instance of recalescence occurring at low temperatures.

Changes in the same direction occur if greater freedom is offered. Under the microscope we may observe sorbite and finally a mixture of well-differentiated phases characteristic of pearlite will appear possessing only a moderate amount of hardness, but considerable ductility. Thus it is that the whole theory of hardening and tempering is applicable for a wide variety of duplex alloys whose mutual solid solubility increases with temperature and whose crystalline phases are the one quite ductile and the other less so.

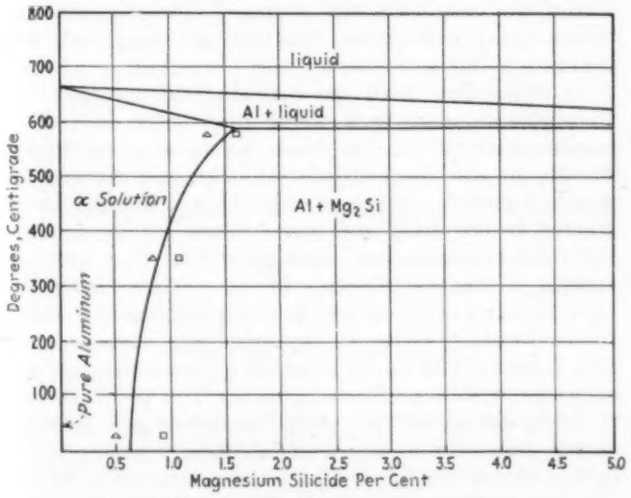


FIG. 4—EQUILIBRIUM DIAGRAM BETWEEN ALUMINUM AND MAGNESIUM SILICIDE[5]

[5]Reproduced from Fig. 36, "Constitution and Age-Hardening of the Alloys of Aluminum With Magnesium and Silicon," by D. Hanson and Marie L. V. Gayler, *Journal Institute of Metals*, No. 2, 1921, vol. 26, p. 321.

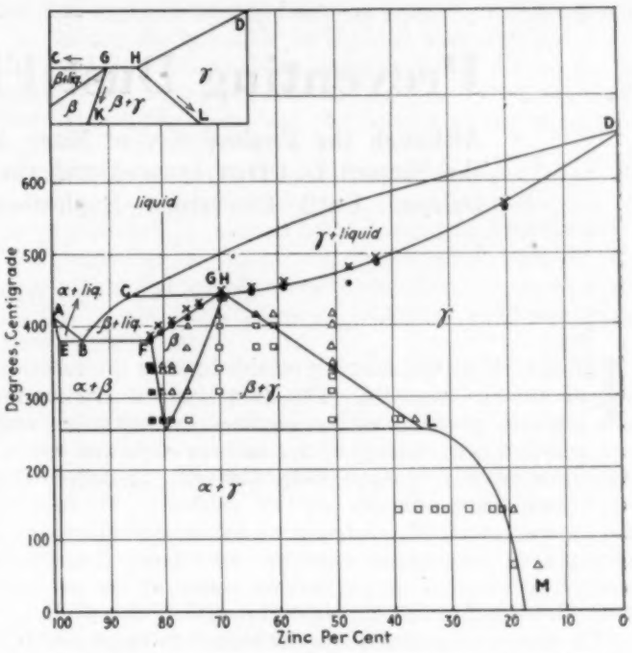


FIG. 5—ALUMINUM-ZINC EQUILIBRIUM DIAGRAM[6]

While detailed figures on the properties which may be induced in the aluminum alloys by heat-treatment will be covered in a later lecture, it is not amiss to emphasize again the nature of martensitic steels.

Westgren has investigated by X-ray methods the space lattice of carbon steel at 1,000 deg. C. (austenite) and finds it to be face-centered cubic arrangement.[7] If this lattice acts as a host to enough carbon, manganese or nickel atoms so that its normal activities are dampened, it can be quenched to room temperature and appear as relatively soft austenitic steel. But if this austenite decomposes slightly on cooling, it becomes intensely hard. Here again the X-rays tell us that this martensite contains particles with body-centered lattice (i.e., ferrite or alpha iron) crystals so small as to be about the size of colloidal gold—i.e., about 100 atoms in diameter. No spectral lines from the previous face-centered lattice are found. Dr. Rosenhain interprets this fact to mean not that *all* the iron was transformed from gamma to alpha, but that the bulk of the iron is quasi-amorphous—disrupted by the precipitation of carbon and the formation of colloidal grains of ferrite. Such crystals of ferrite have little or no keying action—ferrite in itself is too ductile to halt an impending slip in a surrounding crystal. The true reason for the hardness is the disorganized condition of the matrix. Whether carbide crystals are present at this stage, or whether the molecules of cementite have formed is doubtful. X-ray analysis of martensite shows no lines due to cementite crystals, but for that matter, neither would it if the same steel were annealed to the point where Fe_3C is visible under a microscope. Apparently its spectrum is such that it is masked or diffused unless it is present in great excess.

[7]In the *Journal of the Iron and Steel Institute*, May, 1922. Westgren advanced the view that carbon atoms were inserted into the center of the unit cube, but Dr. Rosenhain understands that he has recently abandoned this view for the one that a carbon atom replaces an iron atom at or near its regular position in the normal lattice. Dr. Rosenhain holds this is the make-up of all solid solutions.

Preventing Dust Fires and Explosions*

Although the Explosibility of Many Industrial Dusts Is Easily Demonstrable, the Hazard Is Often Ignored and the Adoption of Effective Control Methods Delayed Until Disastrous Explosions Force Recognition of the Dangers

By David J. Price
Engineer in Charge, Development Work, Bureau of Chemistry

IN MANY manufacturing establishments the creation of dust is essential. The dust itself is the manufactured product, with recognized market value, and its creation is necessary in the various steps and operations followed. It is possible, however, to collect the dust and adopt effective control methods. In fact, it is an indication of efficiency in the manufacture of a product of commercial value to install effective dust-collecting systems which prevent waste of the product and dissemination of the dust throughout the plant.

We now realize that two conditions are necessary for the occurrence of a dust explosion: (1) There must be a proper mixture of dust and air in suspension, which must be of explosive proportions, and (2) this mixture must be ignited by some external source of heat or flame equal to the ignition temperature of the dust. It is now generally accepted that dust explosions cannot occur spontaneously. This must not be interpreted as meaning that there is no such phenomenon as "spontaneous combustion," which is quite a different thing from "spontaneous explosion." It is just as impossible to produce a "spontaneous dust explosion" as it would be to produce a "spontaneous gas explosion." The explosive mixture of dust or gas must be ignited.

Explosive Industrial Dusts

Our knowledge of dust explosions is constantly increasing. It has not been many years since it was generally believed that all carbonaceous dusts were explosive. Experimental work has shown that at least one kind of dust which contains a very high percentage of fixed carbon—anthracite coal dust—is not normally explosive (without the presence of flammable gases), while all types of coal dust with lower fixed carbon percentages are explosive. Explosions of aluminum, magnesium and similar metallic dusts have indicated the danger of industrial dusts of this type. A few years ago the grain industry felt that unless the grain were ground and the starchy material released the dust was not explosive. It has since been proved many times, with telling effect, that dust from the handling of grains in ordinary elevating operations is highly explosive.

It must not be concluded that these disastrous explosions are confined entirely to grain handling or lines of milling, such as flour, feed, cereal and starch. All these industries have experienced disastrous explosions and suffered extensive losses. Explosions of a number of other dusts like powdered milk, fertilizer, rubber, soapine, spice, bark, sulphur, cocoa and cork have also occurred. We must expect the possibility of explosions from any type of industrial plant dusts, with the exception of inert dusts, such as shale or limestone.

*Presented before the Midyear Safety Conference held in Chicago, April 17, 1923, under the joint auspices of the Engineering Section of the National Safety Council, Chicago Safety Council and Western Society of Engineers.

It is not necessary to go into detail at this time as to the causes of dust explosions. It is probably sufficient to state that any source that will ignite the dust or cause it to burn may result in dust explosion. Attention is particularly called, however, to the possible electrical causes and other mechanical sources that have been responsible for recent disastrous dust explosions. These causes have been fully discussed in publications of the Department of Agriculture, which are available for interested safety men. It should be sufficient to state that the matter of prime importance is the control of the dust condition in the plant, together with the elimination of any possible sources of ignition.

Industrial Expansion Increases Hazards

The question as to why we are having so many dust explosions in industrial plants is very frequently asked. To the investigators that have been engaged in a study of this problem for several years the opposite question seems more proper, "Why do we not have more dust explosions in industrial plants?" The industrial expansion to large-scale operation and the increase in capacity and production have increased the quantity of dust produced and added to the dust explosion hazard. Naturally, the more dust created the greater the possibility of dust ignition and explosion. The introduction of new types of milling machinery and equipment has created new ignition sources that have been responsible for disastrous dust explosions, and it must not be concluded that all the recent dust explosions have occurred from common or previously determined causes. This is not the case. On the contrary, investigators have shown many new causes that had not previously been brought to the attention of the investigating agencies.

In connection with the operation of a paper mill, an explosion recently occurred in a drier used in the manufacture of lignone from waste sulphite liquors. The liquor was sprayed into the drier and the moisture was removed by means of superheated steam. A fire started in the drier and was followed by an explosion that did considerable damage. The fire evidently started on top of the superheater. There must have been an air pocket in the drier to furnish the oxygen for combustion, although the drier was supposed to be free from air and under pressure of approximately 1 in. of water with superheated steam. The point we wish to bring out is the fact that, because of new manufacturing processes and equipment, some equipment may be installed which the manufacturer believes to be safe, yet which, through some faulty design, may increase the explosion hazard. In the case cited there should have been no air pockets in the drier and if the equipment had been operating properly no dust should have collected on the hot superheater coils.

The extent of operation of many of our industrial

establishments has greatly increased the dust explosion hazard, particularly in the grain elevator industry. At present elevators in the terminal markets of the United States and Canada are handling as much grain in a day as would be handled in several weeks on the operating scale of only a few years ago. This has naturally increased the possibility of dust settling and accumulating throughout the plant.

We can fully realize the importance of the removal of static or accumulated dust when we consider that dust explosions, as a rule, occur in two stages, (1) The primary and (2) the secondary explosion. When the explosion occurs in a plant that has recently been cleaned and where effective dust collecting methods are practiced, the nature of the explosion is localized and of a minor extent. When dust is allowed to accumulate, however, the original ignition is accompanied by sufficient concussion to shake loose the accumulated dust, which feeds the flame of the first explosion and permits it to propagate throughout the entire plant. This propagation of flame is very rapid and is accompanied by excessive pressures, which cause great damage to property and extensive life losses.

Pneumatic Sweeping Systems for Removal of Static Dust

Attention is being given to the development of effective pneumatic systems for removing static dust. A system of this nature installed in a large industrial plant collects approximately a carload of dust a day. This system has a total of approximately 2½ miles of piping, with about 650 hose inlet connections distributed throughout the building in such a manner that any part of the building or interior structure can be reached with a maximum of 50 ft. of hose.

An efficient system of this nature, installed in industrial plants where explosive dusts are handled, should be of great value in reducing the hazard of secondary explosions. Reports indicate that progress has been made in developing systems of this type for many lines of industry where recovery of the dust is desirable on account of the commercial value of the product. Engineers who undertake the development of pneumatic sweeping systems of this character should fully appreciate the problems that must be worked out before these systems can be successfully installed and operated in handling many types of explosive industrial dusts. The installation should not be undertaken until previous experimental work has shown that the system recommended is of practical value and will operate at high efficiency in the particular type of industry for which it has been designed. The progress already made by experienced pneumatic engineers is worthy of recognition and encouragement, and, in the particular installation referred to, reports indicate that the system is operating with satisfactory results.

Suggested Plan of Action

It is no longer necessary to wait until an explosion occurs with expensive results to demonstrate that the dust in any particular plant is explosive. The Bureau of Chemistry of the United States Department of Agriculture would therefore like to suggest the following plan of action for safety men in dealing with this hazard:

(1) The company should determine the degree of explosibility of dust created during the operating processes. The Bureau of Chemistry has equipment for testing any samples of dust forwarded, or the bureau can advise the company as to what methods might be followed in conducting tests at the plant. There are a number of simple methods that require very little time for determining definitely the possibility of dust ignition.

(2) The bureau is glad to suggest control methods when requested. Frequently a control method effective in one branch of industry is of value in another line. The engineers of the bureau have studied this matter thoroughly and are continually assisting industrial companies in the installation of improved equipment and control methods.

(3) If a safety committee is maintained in the industrial organization, this committee should pay particular attention to dust accumulating throughout the plant and also observe the efficiency of any dust-collecting systems in operation. We must fully realize that, after all, the proposition must be "sold" to the workman, because he is one of the most important controlling factors in dust explosion prevention. Much depends upon him and he cannot be too fully informed as to the possibility of dust explosions.

(4) All dust explosions and resulting fires should be reported promptly to the Bureau of Chemistry, in order to secure the assistance of the engineers in determining the cause and in considering methods of prevention. It is very important that explosions of limited proportions be reported and that the industrial company does not delay action until there is loss of life or property damage. The investigation of a large number of these explosions has very definitely shown that more valuable data have been secured when the explosion was of a minor nature and the destruction neither complete nor extensive. As a rule, workmen can advance information of value in establishing the circumstances under which the explosion originated, a very definite and helpful contribution to dust explosion prevention that it is possible for every safety man to render. Report the "wee, small occurrences" and thereby help to take the "bust" out of combustible dusts.

International Attention to Dust Explosions

A number of international agencies are now considering dust explosion prevention. The National Fire Protection Association, through its committee on dust explosion hazards, has devoted a great deal of time during the past year to a study of the subject as it relates to various types of industries.

The Chamber of Commerce of the United States, through the National Fire Waste Council, is co-operating with the Bureau of Chemistry in bringing the question of dust explosion control to the attention of the chambers of commerce in industrial centers. A special circular on the subject, containing valuable suggestions along the lines of possible co-operation, has been distributed to the fire-prevention committees of the chambers of commerce.

Committees on dust control in grain elevators have been organized by prominent interests in the United States and Canada, to devise ways and means for the control of dust explosions in this particular industry, in which losses have been very great during recent years.

The efforts of these agencies, combined with the co-operation of the industrial companies, should result in the reduction of losses from disastrous dust explosions and fires.

Machinery and Appliances for Production and Control

Equipment News

From Maker and User

Materials and Accessories for Chemical Industries

A New Flow Meter

Most flow meters are based on the principle of measuring a pressure difference caused by the insertion of some such element as an orifice, or venturi tube, in the line of flow. The meter will then consist of this element and the means for recording the flow in the pipe line.

A simple way of measuring the pressure difference caused in the line is with a U-tube or manometer filled with mercury half way up each leg and with the sides to the tube connected to the two sides of the line of flow—that is, across the orifice or venturi.

In making its new flow meter, the H.S.B.W.-Cochrane Corporation has followed this simple theory. The U-tube, if mounted on a pivoted frame and permitted to rotate on a knife edge, will take a position such that the center of gravity of the whole supported structure—U-tube, frame and contained mercury—is vertically beneath the point of support. As the pressure difference causes the height of the mercury columns to vary—as between the two legs of the tube—the tube will then rotate. Its rotation can be made to actuate a pen and in this way draw a chart showing the flow over a given period.

For practical reasons, the U-tube is designed to tilt through only a relatively small angle. In order to have a sufficiently long indicator scale for practical use, an indicating pointer is mounted with a pinion on a shaft which rotates on pivots. A gear sector attached to the U-tube meshes with this pinion. Thus a relatively small swing by the U-tube is multiplied to a large angle of rotation of the indicator pointer. A large scale, visible from some distance, can thus be used.

The pen arm is also arranged to rotate on pivots. A toothed sector attached to the pen arm meshes with a second sector attached to the U-tube beam. The radii of these two sectors are in such proportion that a small tilting of the U-tube is multiplied to a suitable pen swing. The pen draws upon a circular, clock-driven chart concentric with the indicator scale. These two records are shown in Fig. 1, which is a photograph of the dial of a Cochrane flow meter.

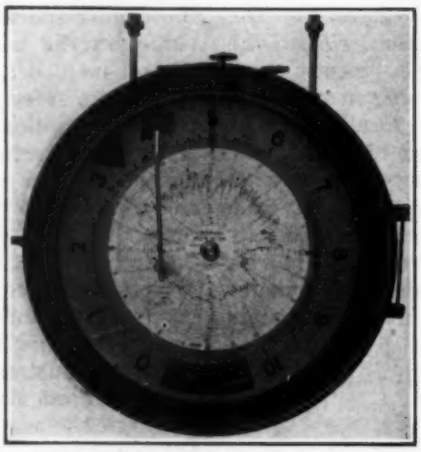


FIG. 1—THE COCHRANE FLOW METER

As the difference between the pressures on the two sides of an orifice varies as the square of the flow, both chart and indicator scale with a simple tilting U-tube would have unequally spaced divisions—that is, the lines would be closer together at low flow, becoming gradually farther apart as the flow increased to maximum.

Uniform scale divisions and a uniformly divided chart are desirable and are obtained by the method shown in Fig. 2. A suitably shaped cam attached to the U-tube beam bears against a flat metal strap kept taut by a weight and guided by a stationary sheave. As the U-tube tilts, an increasing resistance is offered to motion. The cam is so shaped that the tilting is directly proportional to the flow that causes the difference in pressures which acts on the mercury in the U-tube.

The recording pen has a movement in a radial direction on the chart directly proportional to the flow, so that the chart can be integrated with an ordinary radial planimeter. The total pen movement is 4 in. and backlash has been eliminated. A micrometer adjustment provides for setting the pen at zero. The pen, which rests on the chart by gravity, may be lifted to permit replacement of the chart.

The standard element for creating the pressure differential supplied with this flow meter is a sharp-edged orifice in a circular plate of brass or Monel metal, ⅛ in. thick, to be installed inside the bolts, between flanges of the pipe line. Pressure connections to the two sides of the orifice are in this orifice plate itself. In this way these connections have correctly placed and sized openings, and the coefficient of discharge for the orifice is always exactly known.

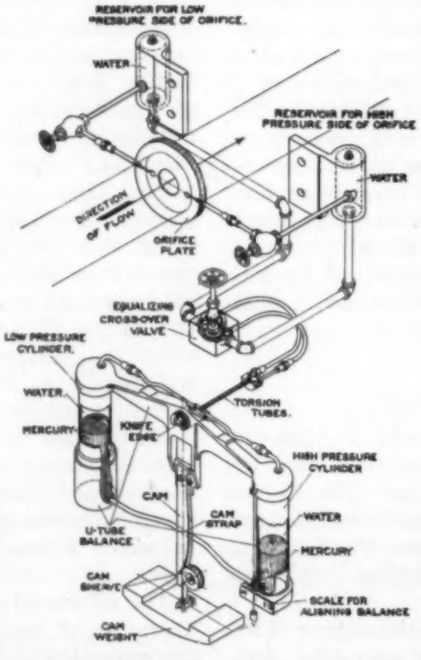


FIG. 2—MECHANISM OF FLOW METER

NH_3 Compressors for Canada

Canadian users of ammonia compressors are to be able, in the future, to procure these machines of Canadian manufacture and standard design. The Canadian Ingersoll-Rand Co., Ltd., of 260 St. James St., Montreal, is placing on the market a line of straight-line and duplex ammonia

compressors for steam, belt, electric motor, or oil engine drive. These machines correspond to those manufactured in the United States by the Ingersoll-Rand Co. of New York. This new service will enable engineers and companies operating refrigerating equipment in Canada to procure compressors of standard design on quick delivery. The Canadian Ingersoll-Rand Co. also handles the full line of machinery, such as pumps, air and gas compressors and similar equipment manufactured by the Ingersoll-Rand Co. in the United States.

Rubber-Lined Barrel

The Cleveland Cooperage Co., Cleveland, Ohio, has recently placed on the market a rubber-lined barrel for the purpose of containing various chemicals which act on ordinary containers or are confined with difficulty and have formerly made necessary the use of glass or lead-lined receptacles.

This barrel was invented by J. H. Gravell, president of the American Chemical Paint Co. It was first used for carrying this company's products. So much interest was aroused in other shippers of similar products that the cooperage company has now undertaken the general sale of the barrel.

The barrel consists of a flexible cylinder of pure rubber suspended in a wooden barrel. The chemical to be transported comes into contact only with rubber surfaces; while the wood barrel serves to protect the rubber container and its contents.

The manufacturers of this container claim for it the following advantages: (1) A saving of 50 per cent in first cost over glass carboys. (2) A saving of 75 per cent of freight charges in long distance hauls as against the glass carboy. (3) Elimination of much breakage and a great saving in depreciation charges over other types of container. (4) A container which is easily rolled, upended, loaded and tiered and hence reduces labor costs. (5) Reduction of the number of accidents which occur when handling acid in glass.

This rubber-lined barrel is offered for the carriage of hydrochloric acid, dilute sulphuric acid, phosphoric acid, spirit varnishes, shellac, extracts, tinctures, ink, castor oil, milk, alcohol and other materials of similar nature. The manufacturers, however, caution users not to use this barrel for nitric acid, gasoline or benzol, carbon tetrachloride, soya bean oil, alcohol containing benzol derivatives or concentrated sulphuric acid.

This line is available, but the makers will sell only to a user who handles a product which test has proved the barrel will hold in a satisfactory manner.

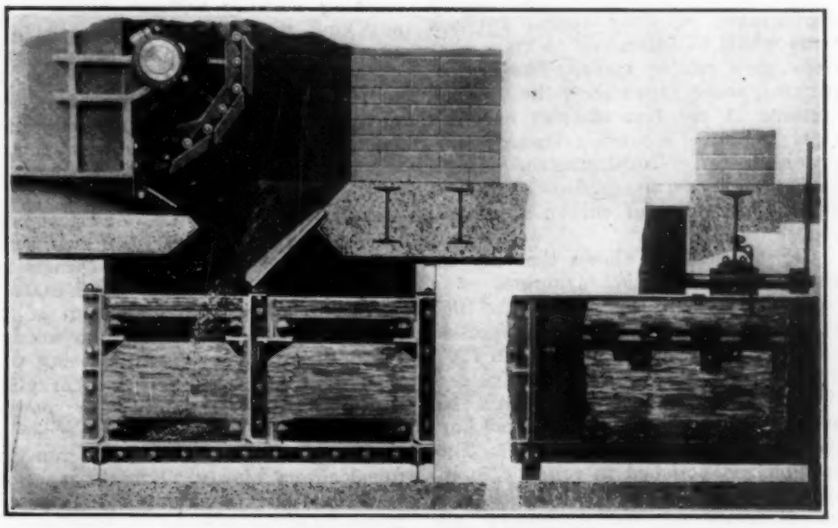
A Unit Ash Conveyor

The medium-sized power plant not large enough to have a railway system running under the boilers for ash handling has long depended on either manual handling of ashes or on various not particularly satisfactory types of mechanical equipment. In order to obviate the difficulties encountered in this work, the Combustion Engineering Corporation, of 43 Broad St., New York City, has introduced a conveyor for this purpose called the "Combusco," which is claimed to be ideal for ash handling.

This conveyor is of the drag chain type with steel scrapers running between two strands of special drop-forged steel chain. The ashes are delivered through a spout to the lower strand of this chain, which runs in a cast-iron trough and carries the ashes out of the boiler house and—generally up a slight incline—delivers them to a storage bin from which they can be carted either by motor truck or freight car. The delivery chute has its delivery end situated inside of the cast-iron trough in which the conveyor runs and this trough is filled with water to such a height that the delivery chute is sealed by water.

It is claimed that by delivering ashes to the conveyor in this manner numerous advantages are realized. First, all dust of fumes and heat in the ash tunnel is prevented. Second, the ashes are quenched as they fall from the furnace. Third, the efficiency of the boilers is aided by the obviation of leakage at the ash discharge. Fourth, when the ashes are quenched in this manner they form a great many small pieces instead of large clinkers and are thereby much easier to handle. Fifth, it maintains a perfect air seal on the combustion chamber.

Besides these advantages claimed for this method of delivery of ash to the conveyor, other advantages are claimed for the equipment in general, such as: It dispenses with all labor except occasional attention to oiling. It permits the boilers to be built on the ground level, as it requires a trench only 4 ft. deep for installation. And because of its long life and elimination of labor it makes the cost of handling ashes per ton during its existence much less than any other method which has been so far developed.



SECTIONS SHOWING WATER SEAL

Catalogs Received

AMERICAN SPIRAL PIPE WORKS, Chicago, Ill.—Catalog 22. A new catalog describing Taylor's spiral riveted pressure pipe, manufactured by the American Spiral Pipe Works. This catalog, besides containing complete information on spiral riveted pipe, also has many illustrations of the various installations which have been made by this company. Appended are a number of valuable tables for the use of those engaged in various kinds of hydraulic engineering.

Readers' Views and Comments

An Open Forum for Subscribers

The editors invite discussion of articles and editorials in *Chem. & Met.* or on other topics of pertinent interest

Clean Steel

To the Editor of Chem. & Met.:

SIR—Dirty steel causes damage to watch parts in two ways. In the polishing processes used to secure a high polish on the heads of screws and on the faces of wheels, the non-metallic inclusions break out, forming a pit which injures the appearance of the part and causes its rejection. In the second place, the balance staff runs on four sapphire jewels, two of which, called endstones, bear against the ends of the staff. Non-metallic inclusions cut grooves in the endstones, causing the watch to lose its time-keeping qualities. Fig. 1 (× 50) shows such a groove in a sapphire endstone.

Several correspondents have shown photographs of dirty steel. Perhaps some would be interested to know that clean steel can be made. The accompanying photographs show the polished sections of the few samples of clean steel we have secured. These photographs are of polished, unetched, longitudinal sections, magnified 100 diameters, of samples of carbon steel drill rod.

Fig. 2 (× 100) shows the only inclusion in the section examined of a sample received in 1901. Fig. 3 (× 100) shows the only inclusion in the section examined of a sample received in 1907. Fig. 4 (× 100) shows an average section of a sample received in 1922. No other specimen has been examined here that was so free from inclusions. This specimen is polished in relief. No inclusions could be formed that, under a magnification of 100 diameters, appeared larger than a few hundredths of of a millimeter.

I believe, after examining many specimens, that the crucible steel made about 20 years ago was more free from inclusions than that manufactured today. I agree with G. F. Comstock that a specimen to be examined for non-metallic inclusions need not be hardened before it is polished.

FREDERICK P. FLAGG.

Chief Chemist,
Waltham Watch & Clock Co.,
Waltham, Mass.

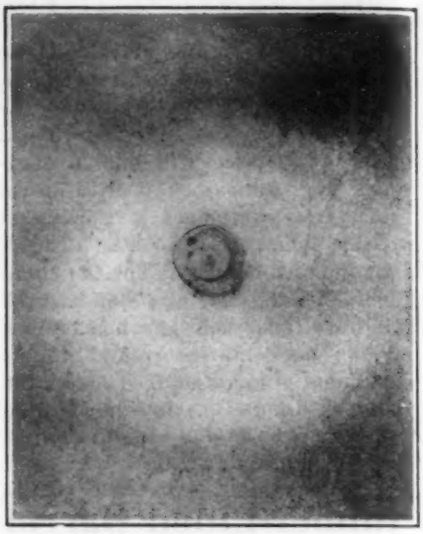


FIG. 1—JEWEL SCRATCHED BY INCLUSION IN STEEL BALANCE STAFF. × 50

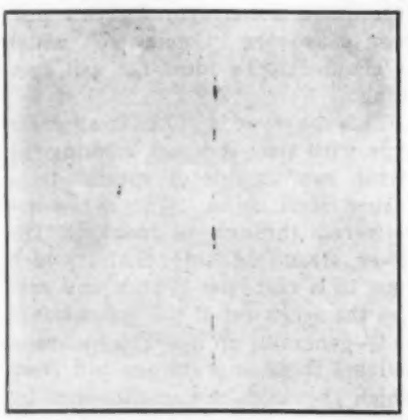
Electric Pig Iron in Brazil

To the Editor of Chem. & Met.:

SIR—It might be of interest to your readers to learn that the first Electro Metal pig-iron furnace in America has been successfully put into operation in Ribeirao Preto, State of Sao Paulo, Brazil.

On April 1 the first tap was made and since then the furnace has been working steadily without troubles of any kind, producing 25 to 30 tons per day. From the description of our plant appearing in *Chem. & Met.* of Dec. 7, 1921, you will find that we have two furnaces, exactly alike, but only one can be operated until a new power station is completed. The furnace is of the size rated at 3,000 kw., but is provided with three G. E. transformers, each with a capacity of 1,550 kva., thus making it possible to run the furnace at a high rate, if so desired. As a matter of fact I believe that an output of 35 tons per day will be easy to attain, the limiting factor of course being the electrodes and their current-carrying capacity. Unfortunately the power supply is also at the present time a limiting factor, and we have to run the furnace very slowly. I might mention here that the smooth curve G. E. regulators, used for varying the low tension voltage from 60 to 120 volts, have proved very satisfactory, making possible a very close regulation of the power input.

When designing the furnaces we did not digress to any great extent from the standard design; only in a few details did we have to make some small changes on account of local conditions. We thought it advisable to decrease the diameter and height of the shaft on account of the higher density of the Brazilian charcoals compared with Swedish charcoals (15 lb. per cu.ft. compared with 9 lb.). The cubical contents of our shaft is only 70 per cent of the standard shaft, and the result has shown itself very satisfactory. As the gases escaping from the furnace top have a temperature seldom exceeding 100 deg. C., it is evident that the height of the shaft could be decreased even more without detrimental effects, but to do so would have meant a radical departure from the usual arrangement, as a certain distance is required between the charging floor and the floor where the electrodes are handled and joined together. For this reason the height of the shaft was hardly changed at all, but on the other hand the diameter at the bosh was quite considerably decreased. This gives the shaft a more cylindrical shape, facilitating the descent of the charge and bringing about a more effective gas circulation which



FIGS. 2, 3, 4—CLEAN STEEL. UNETCHED. × 100

Fig. 2—Only inclusion in 1901 steel

Fig. 3—Only inclusion in 1907 steel

Fig. 4—1922 steel polished in relief

at this type of furnace is of such great importance.

Another slight difference is that the electrodes enter the furnace nearer its center line than is usually the case. By this arrangement relatively cold material will always descend on the electrodes and no semi-fused mass will be formed in front of the electrodes that would prevent the descending charge from arriving in the reaction zones formed round each electrode. In spite of the small change it has proved highly beneficial, improving the regularity of the operation to a marked degree.

By this arrangement the brickwork back of the electrodes, which used to be the weakest point of the furnace, is less exposed to the heat, and the roof consequently stands up better.

The electrical connections on furnaces of the Electro Metal type have been the subject of much study and discussion. On the early furnaces diametrically opposite electrodes were always connected to the same transformer, it being taken for granted that the currents in each phase would pass diametrically across the crucible, thereby providing the greatest possible resistance to the current and making possible to operate the furnace at a higher voltage for a given power input. Investigations, however, have shown not only that such crossings of the currents are impossible, but also that the greatest voltage drop takes place just at the electrodes, the resistance of the actual charge therefore being of small importance. Hence there is no very good reason for connecting diametrically opposite electrodes to the same transformer and consequently adjacent electrodes should be connected, a method that has been followed here in Ribeirao Preto. This arrangement makes possible a very effective interlacing of the busbars, thereby cutting down the induction losses and improving the power factor.

Of course it is much too early to tell anything about the operating results. It will suffice to say that from all indications the power, electrode and charcoal consumption appears to be normal. During the last week, for instance, the furnace produced 178.2 metric tons with a power consumption of 354,000 kw.-hr., or 1,986 kw.-hr. per ton. The average load for the week was only 2,107 kw.

As to the rest of the plant, I might say that the 6-ton Ludlum furnace was put in operation last July and has been working ever since on purchased scrap, producing ingots that have been rolled into bars.

N. A. V. PAULSSON.
Companhia Electro Metallurgica Brasileira,
Ribeirao Preto,
Estado de Sao Paulo,
Brazil.

Review of Recent Patents

Treatment of Gases From Gas Producers—This invention has for its object such a treatment of the gases produced from the gasification of fuel in a gas producer that it becomes possible to obtain the most advantageous operation of the plant from a calorific standpoint and to obtain a complete and continuous conversion of the ammonia in the gas into ammonium sulphate.

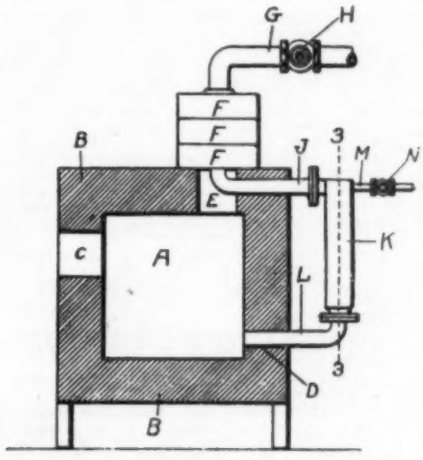
The principal point in this process consists in causing the air that is to be sent in under the grate of the gas producer to pass through the water that has served to cool the gases by spraying. The water is thus cooled and can be used again and the air is heated and at the same time charged with moisture that is useful for the production of water gas in the producer. The circulation of water and its temperature should be adjusted in such a manner that the water will condense the ammoniacal salts only—that is, such salts as do not distill in an aqueous solution—and that this water shall become richer and richer in ammoniacal salts by successive passages in the apparatus for spraying the gases. After the condensation of the fixed salts has taken place, the gases are sent into a closed saturator in which the sulphatation of the ammonia contained in the gases takes place and crystallized ammonia sulphate is produced.

In order to supply the saturator with heat necessary for dilution of the bath and for insuring crystallization of the sulphate, the saturator should be provided with a heating device fed with steam. This steam may be taken from the jacket of the gas producer or from the discharge of an engine, and afterward the steam is fed into the circuit of the air that is fed under the grate of the gas producer. The water of condensation contained in the fixed ammoniacal salts, concentrated by their successive passages through the gases, is used for diluting the sulphuric acid in a receptacle placed in line before the saturator, and in this receptacle a first formation of ammonium sulphate takes place with the elimination of harmful acids, which escape directly from the said receptacle without entering into the gas circuit at all. (1,450,562. Oliver Piette, Brussels, Belgium. April 3, 1923.)

Varnish Composition—Cheaper gums than are ordinarily used in oil varnishes may be employed in compounding if an aryl ester of an inorganic acid is added in compounding. Triphenyl phosphate is especially recommended as a suitable substance to use. Not only is it possible to use cheaper materials by employing this substance but also superior qualities are imparted to the resulting product, it is claimed by the inventors, P. Rothberg and A. P. Sachs, of Summit, N. J., and Manhattan, N. Y. (1,448,869. March 20, 1923.)

Producing Gaseous Fuel—In high-temperature furnaces such as are employed for metallurgical purposes, in order to maintain the requisite temperature, the fuel oil must be introduced into the combustion chamber in the form of a gas premixed with the proper proportion of air to effect the complete combustion. The temperature of the furnace is dependent upon the temperature of the combustion of the fuel supplied to it.

This invention is concerned with a method for preheating the air, premixing it with the fuel and introducing the fuel in the form of a vapor or gas with the correct proportion of air so that the highest possible temperature and complete combustion may be obtained in the furnace. The means for effecting this consists of a counter-flow preheater in which the air is preheated by the exhaust fumes from the furnace, a vaporizing chamber in which the oil is injected and thoroughly intermixed with the air and control valves on the air and oil supply, so that the proportion may be definitely regulated, all as shown in the accompanying cross-section of a furnace to which this type of burning equipment has been applied. In the illustration, the preheater is shown at *F*, the control valves at *H* and *N*, and the vaporizing chamber at *K*, while the gas for combustion is introduced into the combustion chamber *A* at *D*. (1,450,338. M. Sklovsky, assignor to Deere & Co., of Moline, Ill. April 3, 1923.)



Paper Pulp Process—If a small amount of hydrosulphurous acid, a powerful reducing agent, is introduced into the cooking acid used in the sulphite process, an increased and improved yield is obtained. The bisulphite liquor is made up in the usual manner and the hydrosulphurous acid, which may be made specially from such a source as sodium hydrosulphite, is added. Another recommended method of producing the hydrosulphurous acid in the liquor is that of addition of zinc

to the cook, in which case, by reaction with the sulphurous acid present, hydrosulphurous acid results. Ordinarily the addition of from 1 to 2 lb. of zinc dust to a ton of charge in the digester is sufficient to bring about the desired condition. This process has been patented by B. S. Summers, of Port Huron, Mich. (1,451,125. April 10, 1923.)

Sulphur Burner—In the manufacture of sulphuric acid by burning crude sulphur to form sulphur dioxide, there is a necessity in certain cases to use a sulphur high in ash. The purpose of the present invention is to provide a continuous burner for such a sulphur.

This burner comprises a stationary cylindrical shell forming the combustion chamber or burner proper and inclined to the horizontal at a slope of about 1 in. per foot of length. The ends of the shell are closed at each end of the cylinder, making it practically a closed combustion chamber. At the top and near the lower end is the sulphur inlet. This inlet is of the screw conveyor type and makes a positive feed. In this same end of the chamber, somewhat above the bottom, is a port which serves for admitting air for combustion and for overflow of excess sulphur. At the upper end of the drum is the ash outlet connected tangentially to the drum. This ash outlet is located somewhat above the line of sulphur in the burner, thus preventing loss of sulphur with the ashes. The outlet for sulphur dioxide is also at this upper end of the drum and is provided with a suction fan for drawing air into the burner from the other end and for removing the sulphur dioxide at this end. Within the burner is a water-cooled shaft upon which are mounted numerous paddles set at an angle, so that when the shaft rotates the ashes are conveyed to the upper end of the burner. These blades are of a comparatively narrow and ribbon-like structure, so that they will not interfere with the passage of the gases through the burner. However, in order to provide proper conveyance of the ash to the ash outlet, the blades are set in sufficient numbers on the rotating shaft so that their ends overlap. (1,450,677. Horace G. Chickering, assignor to E. I. du Pont de Nemours & Co., Wilmington, Del. April 3, 1923.)

American Patents Issued May 8, 1923

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

1,454,113—Oil Filter. C. A. Hamilton and B. F. Noyes, Bayonne, N. J.

1,454,142—Means for Cracking Hydrocarbons. H. A. Wier and S. A. Wier, Dallas, Tex.

1,454,153—Process of Preparing Sugar. J. Carr, Esher, and A. B. Bradley, Fulham Park, England.

1,454,211—Gas-Pressure Regulator. W. P. Capps, Shreveport, La.

1,454,214—Fused Salt Bath for Heating Steel in Hardening. R. S. Dean, Cicero, Ill., assignor to the Western Electric Co., New York City.

1,454,248—Filtering Apparatus for Air and the Like. S. J. Marx, Cleveland, Ohio, assignor to the Cleveland Air Engineering Corp., Cleveland, Ohio.

1,454,255—Apparatus for Electrical Precipitation of Suspended Particles From Gases. C. H. Weiskopf, Santa Monica, Calif., assignor to International Precipitation Co., Los Angeles, Calif.

1,454,291—Cast Metal Container. J. G. Lehman, Bethlehem, Pa., assignor to Bethlehem Foundry & Machine Co., Bethlehem, Pa.

1,454,300—Combination Agitator and Sampler. L. Sturges, Chicago, Ill., assignor to Solar-Sturges Manufacturing Co., Chicago, Ill.

1,454,301—Fluid Meter. L. E. Van Hise, Los Angeles, Calif., assignor of one-third to J. V. Baldwin, one-third to G. E. McCreery and one-third to P. F. Howell, all of Los Angeles, Calif.

1,454,338—Furnace Retort. C. E. Richardson, Newark, N. J., assignor to International Coal Products Corp., Richmond, Va.

1,454,339—Method of Treating Cellulose Pulp to Remove Odors Therefrom. G. A. Richter, Berlin, N. H., assignor to the Brown Co., Portland, Me.

1,454,341—Safety Control for Automatic Gas Appliances. G. F. Schwartz, St. Louis, Mo.

1,454,344—Solidifying Molten Sulphur. R. H. Stewart, Vancouver, Canada, assignor to Texas Gulf Sulphur Co., Bay City, Tex.

1,454,377 — Process of Elevating Liquids. J. C. Grant, London, England.

1,454,414—Progressive Nitrocellulose Powder Containing Nitroguanidine. J. M. Skilling, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.

1,454,419—Apparatus for Continuous Extraction, Particularly of Oil. M. Wilbuschewitsch, Zurich, Switzerland.

1,454,462-3—Process of Esterification and Process of Producing High-Grade Esters. A. A. Backhaus, Baltimore, Md., assignor to United States Industrial Alcohol Co.

1,454,485—Process of and Apparatus for Treating Hydrocarbon Oils. J. P. Persch, Houston, Tex., assignor of one-fifth to B. Tolles, Hohokus, N. J.

1,454,491—Tube Mill. E. C. Soper, Chattanooga, Tenn.

1,454,521—Process of Making Ethyl Alcohol From Galactose. E. C. Sherrard, Madison, Wis., dedicated to the people of the United States.

1,454,564—Process of Producing Zirconium Dioxide. Otto Ruff, Breslau, Germany.

1,454,567—Method and Apparatus for Producing a Chemical Union Between Hydrocarbon Gases and Hydrocarbon Oils. H. B. Snyder, Fullerton, Calif.

1,454,581—Process of Treating Vegetable Fiber. H. C. Fueller, Jacksonville, Fla.

1,454,583—Process of Producing Magnesium Nitrate. V. M. Goldschmidt, Christiania, Norway, assignor to A/S De Norske Saltverker, Bergen, Norway.

1,454,591—Method of Treating Gases. A. Naglevoort, Providence, R. I., assignor to the Nitrogen Corporation, Providence, R. I.

1,454,593—Method of Purifying Mineral Oils. E. E. Arnold, Coventry, R. I., assignor to the Nitrogen Corporation, Providence, R. I.

1,454,599—Process of Ammonia Synthesis and Catalyst Therefor. J. C. Clancy, Providence, R. I. assignor to the Nitrogen Corporation., Providence, R. I.

1,454,604—Process of Making Glycol. W. H. Rodebush, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.

1,454,606—Paper-Making Machine. J. D. Tompkins, Valatie, N. Y.

1,454,609—Apparatus for Use in the Manufacture of Aldehydes. E. J. Winter, Baltimore, Md., assignor to the United States Industrial Alcohol Co.

1,454,610—Bleaching Pulp and Apparatus Therefor. R. B. Wolf, New York City.

1,454,612—Carburizing Material and Process of Making Same. L. Aeby, East Chicago, Ind., assignor to Chicago Flexible Shaft Co., Chicago.

1,454,616-7—Process for Resolving and for Preventing the Formation of Emulsions. E. E. Ayres, Jr., Chester, Pa., assignor to the Sharples Specialty Co., Philadelphia, Pa.

1,454,687—Method of Making Acid-Proof Containers. J. E. Perrault, Watertown, Mass., assignor to Hood Rubber Co., Watertown, Mass.

1,454,694—Leather Drier. W. M. Schwartz and E. B. Ayres, Philadelphia, Pa., assignors to Proctor & Schwartz, Philadelphia, Pa.

1,454,705—Method of Extracting Oil. F. P. Croft, Philadelphia, Pa.

1,454,708—Manufacture of Carbon Bisulphide. A. E. Delph, Workingham, England, assignor to Courtaulds, Ltd., London, England.

1,454,747—Apparatus for Manufacturing Flowers of Sulphur. E. Knapp and J. K. Dickerson, Middleport, N. Y., and F. L. Begtrup, Louisville, Ky., assignor to Niagara Sprayer Co., Middleport, N. Y.

1,454,838—Concentration of Minerals. W. O. Borcherdt, Austinville, Va., assignor to the New Jersey Zinc Co., New York City.

1,454,839—Fire Extinguishing Apparatus for Oil Tanks. W. D. Witter, Roselle Park, N. J., assignor to the Foamite Firefoam Co., New York City.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

British Patents

For complete specifications of any British patent apply to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Cellulose From Wood—In a process for obtaining cellulose from wood and the like by treatment with chlorine peroxide and subsequently with alkaline lye, the chlorine peroxide is used in solvents, such as dilute acetic acid, which dissolve the liquor after it has been transformed by the chlorine peroxide. (Br. Pat. 191,357; not yet accepted. E. Schmidt, Berlin, Germany. Feb. 28, 1923.)

Dioxyperylene—If dioxydinaphthyl is heated with ring-closing condensing agents, such as aluminum chloride, dioxyperylene is obtained. Basic substances, such as the oxides, hydroxides or carbonates of alkali and alkaline earth metals, are preferably added to the mixture. Specifications 165,770 and 165,771 are referred to. (Br. Pat. 191,363; not yet accepted. H. Pereira, Vienna, Austria. Feb. 28, 1923.)

Paper — A further development in utilizing rubber latex efficiently in paper making is obtained by adding a small quantity of soluble alkaline sulphide to the same before it is diluted and mixed with paper pulp in the process described in the parent specification. On addition of acid to coagulate the rubber, etc., sulphur is deposited for the subsequent vulcanization. With acid fibers, or paper sized with resin and alum, the addition of acid may be unnecessary. Sufficient sulphide to produce 1 to 2 per cent sulphur calculated on the rubber content is usually enough, but quantities to produce 10 per cent may be added. (Br. Pat. 191,446. F. Kaye, Ashton-on-Mersey. Feb. 28, 1923.)

Synopsis of Recent Literature

Utilization of Waste Lime Rock

Most of the lime manufactured in the United States is burned in various types of shaft kilns. The fuel and limestone may be added in alternating layers, as in pot kilns, or the fuel may be burned beneath the stone, the flames and hot gases passing up through the spaces between the rock fragments. The necessary draft is maintained either by a tall stack, a power fan, or in certain cases by natural currents.

The necessity of a good draft is a great detriment to the utilization of small-sized fragments of stone, for if large quantities of the finer materials are mixed with the larger masses the draft is greatly retarded and imperfect calcination results. For this reason rock below 4 in. in diameter is usually either discarded or diverted to other uses. In this way, in many cases, a large waste is entailed.

With the growing tendency toward underground operations in lime quarries the problem of utilization of small rock is becoming more urgent, since a much larger part of the rock comes out in the finely divided form.

Of the possible means of burning the smaller fragments either a rotary or a Mount kiln is most commonly used. Since either one of these types of apparatus is rather expensive, neither can be used economically unless the output of the plant is quite large. For plant operating twenty to twenty-four shaft kilns the addition of one Mount kiln for small fragments, and one rotary kiln for fine, is regarded by some as an ideal equipment which will utilize practically the entire quarry output. The Interior Department, Bureau of Mines, from whose publication this information comes, is at the present time working upon the problem of burning small-size rock in the ordinary shaft kiln.

However, as alternate means of disposing of fragments from 2 to 7 in. in diameter several possible outlets may be developed. Open-hearth steel furnaces usually demand stone not less than 4 or 5 in. in diameter, but for blast furnaces smaller stone may be used. This use, however, is limited not only by the demand, but by transportation, for it is too low priced to warrant a heavy haulage charge. Fragments unsuited for lime manufacture are used extensively for road building, and also as ballast and riprap for railway construction. However, these last two applications are of local significance only. Still further uses for small fragments are for use in terrazo floors, for facing concrete blocks, or as a substitute for sand in mortar and wall plaster.

There is also a growing tendency to use pulverized limestone as liming for land. When this means of outlet is resorted to, large storage space for the product between seasons is necessary, because the demand for agricultural limestone is seasonal. Limestone pulverized to a much finer grade than for agricultural use is finding wide application in various products. Small quantities may be added to stock food as a bone builder. A dust—approximately 80 per cent of which will pass a 200-mesh screen—is the most widely used filler in road asphalt surface mixture, although slate flour, portland cement and hydrate of lime are used to some extent. Ground limestone is used, to a limited extent, as a fertilizer filler. Very finely pulverized stone may be used successfully as a whiting substitute in certain classes of rubber, paint and other products. It is essential for such uses that it be very finely ground and uniform in size so as to exclude all comparatively large-size grains. In general the limestone flour that will successfully meet the requirements of fillers such as whiting or china clay should approximate 300-mesh size.

Seaboard Liquid Purification Process

Enough has been written of the Seaboard process of liquid purification of gas so that by this time engineers are thoroughly familiar with the theory. The process has now been in use for some time and reports of its success over a varying length of time are beginning to come to hand. In *Gas Age-Record* for April 21, 1923, H. R. Broker reports the various advantages and disadvantages of the method as they have worked out in the plant at Racine, Wis.

The apparent advantages were:

First—Low cost of installation. A wet process plant designed to obtain 90 per cent sulphur removal for 3,500,000 cu.ft. send-out costs approximately $11,000. One additional oxide box would cost approximately this amount and would not remove 30 per cent of the sulphur.

Second—Low cost of operation. As near as could be determined the cost of operation would not exceed 0.7 cent per thousand cubic feet of gas purified, including royalty, labor and materials, as against 1½ to 2 cents for the oxide method.

Third—Labor is practically eliminated. No additional men are required; the only labor connected with the process is in adding soda ash daily and in oiling pumps and fans. In any plant not sufficiently large or not adapted entirely to mechanical handling of oxide, there is a labor charge, as every operator knows, that does not show on the books. There is a tendency to carry some men on the payroll primarily to have them available when a box is to be emptied.

Fourth—By varying the strength of solution and rate of circulation, the Seaboard process is apparently capable of removing 90 per cent of the sulphur whether a 400-grain gas or 1,000-grain

Important Articles in Current Literature

More than fifty industrial technical or scientific periodicals and trade papers are reviewed regularly by the staff of *Chem. & Met.* The articles listed below have been selected from these publications because they represent the most conspicuous themes in contemporary literature, and consequently should be of considerable interest to our readers. Those that are of unusual interest will be published later in abstract in this department; but since it is frequently impossible to prepare a satisfactory abstract of an article, this list will enable our readers to keep abreast of current literature and direct their reading to advantage. The magazines reviewed have all been received within a fortnight of our publication date.

RUBBER SOFTENERS. Paul M. Aultman and C. O. North. *Rubber Age*, May 10, 1923, pp. 100-101.

SUGAR CANE BAGASSE AS PAPER STOCK. Dr. H. Kumagawa and Dr. K. Shemomura. *Paper*, May 2, 1923, pp. 7-10.

OPERATING CONTROL IN PULP MAKING. R. Sieber. *Paper*, April 25, 1923; pp. 11-14.

SOLVENT RECOVERY, FIRE HAZARDS IN. W. D. Milne. *Quarterly of National Fire Protective Assn.*, April, 1923, pp. 346-57.

PRINCIPLES OF HEAT TRANSFERENCE. Geoffrey J. Greenfield. (Concluding chapter). *Chem. and Ind.*, April 27, 1923, pp. 417-9.

MECHANICAL METHODS FOR THE PROPULSION OF GASES. E. F. Hooper and B. B. Waller. *J. Soc. Chem. Ind.*, April 27, 1923, pp. 180T-184T.

DESIGN OF HOT-AIR DRYING PLANT. George H. Gill. *Engineering* (London), First Part, April 27, 1923, pp. 511-512.

SUGGESTIONS FOR SAVING HEAT IN MANUFACTURING PLANTS. Charles L. Hubbard. *Power*, May 8, 1923, pp. 704-708.

THE USE OF PULVERIZED COAL (IN CEMENT KILNS). H. A. Schaffer. *Power*, May 8, 1923, pp. 718-719.

IMPROVED METHOD OF UTILIZING OLD FIREBRICK. James A. Faulkner. *Power*, May 15, 1923, pp. 754-756.

RESTORING USED STEEL BARRELS. *Oxy-Acetylene Tips*, May, 1923, pp. 7-8.

BRITISH STEEL WORKS GAS PRODUCER PRACTICE. Fred Clements. Paper for May, 1923, meeting, *Iron and Steel Institute* (England).

MODERN THEORIES OF DETERGENT ACTION. T. Hedley Barry. *Chemical Age* (London), April 28, pp. 446-448.

INDUSTRIAL USES OF HYDROGENATED OILS. W. W. Middleton. *Chemical Age* (London), April 28, pp. 448-450.

MANUFACTURE OF OLIVE OIL. *Chemical Age* (London), April 28, pp. 452-453.

EFFECT OF SOME SUBSTITUTES FOR TIN OXIDE ON THE OPACITY OF WHITE ENAMELS FOR SHEET STEEL. R. R. Danielson and M. K. Frehafer. *Journal American Ceramic Society*, May, 1923, pp. 634-644.

REVERSIBLE THERMAL EXPANSION OF REFRACTORY MATERIALS. H. S. Houldsworth and J. W. Cobb. *Journal American Ceramic Society*, May, 1923, pp. 644-662.

REFRACTORY POSSIBILITIES OF SOME GEORGIA CLAYS. R. T. Stull and G. A. Bole. *Journal American Ceramic Society*, May, 1923, pp. 663-673.

GLASS WOOL HEAT INSULATION IN EUROPE. A. D. Saborsky. *Journal American Ceramic Society*, May, 1923, pp. 674-684.

WEEKLY SUMMARY—GRAINS H_2S

Week Ending	Gas Make for Week, M. Cu. Ft.	Average Make per Day, M. Cu. ft.	Average Inlet	Average Outlet	Per Cent Removal	Lb. H_2S Removed	Lb. Soda Consumed	Lb. Soda per M. Cu. Ft. Gas	Lb. H_2S Removed per Lb. Soda Consumed
Jan. 14	17,001	2,429	690	190	72.5	12,120	1,830	0.108	6.63
Jan. 21	18,873	2,696	660	245	63.0	11,180	1,469	0.078	7.61
Jan. 28	18,390	2,627	720	295	59.0	11,170	1,350	0.073	8.26
Feb. 4	19,520	2,789	670	240	64.2	12,000	1,300	0.067	9.23
Feb. 11	19,140	2,734	670	220	67.1	12,310	1,550	0.097	7.94
Feb. 18	16,809	2,401	625	200	67.9	10,200	1,200	0.072	8.50
Feb. 25	21,037	2,964	595	175	70.6	12,820	825	0.040	15.1
Mar. 4	20,580	2,940	590	175	70.3	12,200	525	0.025	23.2
Average	18,919	2,698	652	217	67.8	11,750	1,256	0.070	10.8

Solution: Rate 60 gal. per M.; temp. 60 deg. F. Actifier air: 40 cu.ft. per gal.; temp. 60-100 deg. F.

gas is being treated. This is, of course, not true of oxide purifiers.

Fifth — Possible elimination of stopped services and ruined meters from hydrocyanic acid.

It has been known for many years that a large part of the hydrocyanic acid in the gas has been going through the oxide boxes and into the mains. During recent years a large part of the so-called rust troubles and meter troubles have been traced to this compound. The Seaboard process removes a large part of the cyanides (80 to 90 per cent), sufficient so that the oxide boxes can handle the residue.

The design and operation of the apparatus are more technical than it may first appear from the simplicity of the process, as we soon learned after putting the plant into operation. There are several factors which have a very material effect on the efficiency of operation, most noteworthy of which are the size of coke, depth of packing, rate of circulation, and type of sprays or efficiency of distribution of liquor.

The plant was started in cold weather and we immediately found that we were chilling the gas with the resultant deposit of naphthalene in the actifier. It will be noted that the actifier is quite an efficient cooler when cold air is used. We were blowing 5,000 cu.ft. of air per minute (sometimes at a temperature around zero) through the actifier and absorbing heat from the liquor; this cold liquor again coming in contact with the gas in the absorber. It was found necessary to either heat the liquor entering the absorber or to heat the actifier air.

About 2 weeks after starting the plant we got into trouble from a strong odor of hydrogen sulphide around town. This was noticeable within an area of a mile from the plant. We immediately conferred with Koppers engineers, who recommended dilution of the actifier air as it left the stack. We had two old fans at hand having a combined rated capacity of about 25,000 cu.ft. of air per minute, which were connected to the outlet of the actifier temporarily.

At the same time Prof. O. L. Kowalke was called to give us some information regarding the amount of hydrogen sulphide air would carry without detection. He advised that 1 part in 10,000 was noticeable. The actifier air contained approximately 1 part in 300, so that it would be necessary to use 35 cu.ft. of dilution air per cu-ft. of actifier air discharged, or 175,000 cu.ft. of dilution air per minute. The diluted air would need to be very thoroughly mixed and discharged above the surrounding buildings. The cost of suitable fans, stack and necessary power made this scheme prohibitive. The only remaining positive solution was to burn the actifier air.

During the time we were discharging the air into the atmosphere we had complaints of sickness that were undoubtedly in part psychological. Silverware and copper in restaurants near by turned black over night.

Up to the time of writing, the apparatus has not come up to the contemplated efficiency, but we have sufficient reason to believe that when smaller coke is put in and the sprays properly adjusted, we shall be able to get at least 90 per cent removal of hydrogen sulphide.

The accompanying table of operating data is a summary of results for 8 weeks, which time the plant was in continuous operation. From the data sheet a striking difference in soda consumed is noticeable for the last week and a half. Steam had been admitted at the bottom of the actifier to saturate the air and prevent loss of water from the soda solution, and at the same time utilize the heat in this waste steam. The difference in soda requirements when the steam was shut off shows the fallacy in its use. The results for the last week represent very good efficiency in soda requirements.

Due to the short time, and the numerous difficulties encountered, it is impossible to give a just estimate of the cost of operation.

The conclusions drawn are:

First—We have not lost faith in the process and believe it will work out satisfactorily.

Second—We feel justified in believing the process not feasible near business or dwelling houses without burning the actifier air; as our experiments with dilution, although not complete, indicate that the people controlling the process have no ground to justify their recommending dilution.

Third—The sizes of shells, fans, pumps and all engineering data will stand considerable investigation before the most efficient plant can be specified to be used under any given set of conditions.

Book Reviews

TABLES ANNUELLES DE CONSTANTES ET DONNÉES NUMÉRIQUES DE CHIMIE, DE PHYSIQUE ET DE TECHNOLOGIE. Vol. IV, 2nd Part, 1913-1916. By *Ch. Marie*, secretaire général du Comité international. Couthier-Villars et Cie. (Paris). University of Chicago Press (Chicago), 1922. 627-1377 pp. 22x27 cm. Price, $13.25 net.

An international committee was organized at the Eighth Congress of Applied Chemistry in London, June, 1909, for the purpose of collecting and publishing annual tables of physical constants and other numerical data. This committee published Vols. I, II and III, containing, respectively, data for the years 1910, 1911 and 1912. The preparation of the succeeding volumes was interrupted by the war. The work has now been resumed under the patronage of the International Research Council and the International Union of Pure and Applied Chemistry. The original secretary of the committee, Professor Marie, has continued in charge of the work, and Vol. IV contains data for the 3-year period 1913-1916. Work on Vol. V, containing data for the years 1917-1922, is about completed and it is hoped that Vol. VI will contain data for 1923 and 1924 and thereafter the publication again become annual.

The present volume embraces data on electricity, magnetism, atomistic properties, radioactivity, cosmic physics, atomic weights, molecular weights, transition temperatures, diffusion, osmotic pressure, solubility, calorimetry and thermochemistry, chemical equilibrium, velocity of reaction, electrolytic conductivity, electrochemical equivalents, electromotive forces, colloids, crystallography and mineralogy, organic chemistry, essential oils, fats and waxes, biology, vegetable physiology and chemistry; engineering data classified under (1) mechanical constants, (2) electrical constants, (3) physical and chemical properties of fuels; metallurgical data classified under (1) metals and alloys, (2) mechanical constants, (3) electrical constants; supplement.

The data are concisely and systematically arranged, and complete literature references are given. The manner in which the compilation is made is designed to promote completeness and accuracy. The information in all cases was collected by collaborators residing in the various countries and then forwarded to the central office in Paris. From there it was distributed to specialists who undertook the compilation of each separate section.

The total represents an expenditure of considerable effort, which is, for the most part, contributed by zealous individuals impelled by their interest in science who received either no pay or very inadequate pay. The value expressed as effort put into the compilation is certainly many times the sum

of money received for its support as grants and from the sale of the publication. A purchaser may accordingly be assured that he is not only buying a volume that is an invaluable aid to research in every laboratory, but he is supporting an undertaking designed for the general advancement of science and industry.

Furthermore, generous support is especially needed at the present time on account of the increasing difficulties of publishing the tables with the funds so far available. When one considers the very small sums that have been collected, the amount accomplished is remarkable. The undertaking is certainly one that should receive more liberal and regular support than it has in the past. ATHERTON SEIDELL.

BRIQUETTING. By *Albert L. Stillman*, E.M., M.Sc. The Chemical Publishing Co., Easton, Pa. 6¼x9 in., xi + 466 pp., with 160 illustrations. Price, $6.

The author states in the preface: "Although thousands of tons of briquets are manufactured each year, from all classes of raw materials, the only textbook to date published on the subject is the very comprehensive work 'Handbook of Briquetting,' by Prof. G. Franke, translated from the German by Prof. F. Lantsberry. It is, therefore, thought that a book on the subject, presenting it from the American standpoint, will be of interest."

The author has prepared a text on briquetting that is interesting and valuable to American engineers, in describing machinery, binders and methods for briquetting various materials with special reference to American practice. A brief introductory chapter on raw materials is followed by 71 pages describing the various types and classes of briquet presses of both American and foreign makes. Manufacturers' names are given and installations are described with comments on the commercial success or failure of the press.

Chapters III to V inclusive describe the briquetting of steel swarf and turnings, cast-iron boring and non-ferrous metals swarf and scrap. Particular attention is called to the various types of gas and electric furnaces for melting metal briquets and to the reduction of melting losses by the use of briquets rather than loose scrap.

Chapter VI, on "A Discussion of Binders," and Chapter X, on "Principles of Briquetting With Binders; The Briquetting of Coals; Combustion of Fuel Briquets," are full of valuable and practical information based on the author's extended experience in briquet engineering. He does not stop with a mere description of different types of binders, but discusses their advantages and disadvantages and the extent to which the binders and processes have proved commercially successful.

Chapter XI, on "A Chronology of Coal Briquetting in the United States and Canada," discusses the reasons for failures in fuel briquetting and points out the difficulties to be avoided in future construction. Briquetting plants are described from the first one at Port Richmond piers, Philadelphia, Pa., in 1872 to the Nukol plant at Port Stanley, Ontario, built in 1921.

Other chapters in the book cover the briquetting of sawdust, wood wastes and charcoal; the winning, drying, distillation and briquetting of peat and peat char; the carbonization and briquetting of lignite, *braun kohle* and lignite chars; the briquetting of coke braize, low-temperature cokes and petroleum carbon; briquetting of flue dust and ores; and laboratory research in briquetting. Comprehensive bibliographies and lists of patents are given at the end of each chapter.

There are a few minor errors. On page 9 it is stated that "The United States Government Bureau of Mines is at present engaged in investigating the distillation of waste straw and kindred products." It was the U. S. Department of Agriculture that made this investigation and not the Bureau of Mines.

Also on page 236 reference is made to a contract between the Bureau of Mines, John B. Adams and Fred Bremier for the erection of a commercial lignite carbonizing and briquetting plant in Dakota. This contract was not completely signed and the construction of the plant was never started. On page 237, "Grand Forge" should be "Grand Forks," North Dakota. Most of the subject matter is selected with excellent judgment that reflects the author's experience in briquetting.

A. C. FIELDNER.

THE WORKING OF STEEL. ANNEALING, HEAT-TREATING AND HARDENING OF CARBON AND ALLOY STEEL. By *Fred H. Colvin* and *K. A. Juthe*. McGraw-Hill Book Co., New York. 250 pp. Price, $3.

This is a revision of what is probably the best and most handy volume on heat-treatment so far printed. The first forty-five pages of the book, containing chapters on Steel Making, Composition and Properties of Steel, Alloys and Their Effect on Steel, cover the subject in as complete a manner as is necessary. The authors are to be commended for getting into this short space a mass of pertinent information that usually occupies far too great a volume in most text books. Much of the reading matter has been rewritten with improvement. The classification of steels appearing on page 11, and the matter on the physical testing of steels, are useful additions which did not appear in the first printing. Chapter VIII is on Heat-Treatment, and is greatly altered, especially the part that discusses the principles of the art. It is markedly improved and actually is the "heart of the book." It appears to the reviewer that this chapter should replace Chapter IV, and if it were so the authors would have condensed the subject of heat-treatment into less than 100 pages, which is truly a remarkable performance. Chapter IV at present contains some remarks on the application of Liberty engine materials to the automotive industry. In the reviewer's opinion, this is out of place. A serious criticism might be leveled that while Liberty engines might have been a wartime commodity, there is some question as to whether peace-time articles can be manufactured with the same precision.

Chapters V, VI and VII, on Forging, Annealing and Case-Hardening, contain many corrections. Annealing deserves more space than the four pages the authors have given it; the subject of normalizing—an annealing operation—is conspicuously absent. While the general treatment of case-hardening is excellent, it is probably dangerous to advocate mixing carburizers in the shop when much more uniform materials for this purpose are purchasable from a number of sources which have command of the raw materials required. Cyanide hardening is not discussed, which is a strange omission. The balance of the book, on Hardening Carbon Steels, High-Speed Steels, Construction of Furnaces, and Pyrometry, are the same as in the first edition. It is to be regretted that the authors have not inserted some more advanced tables at the end of the book, in addition to the simple ones which are now found.

Those practicing the art of heat-treatment will find that "Working of Steel" is a book containing practically everything required in a technical way for the execution of their art, which naturally employs the method of trial and error quite extensively. It is a book that should be owned by all heat-treaters, and it is believed by the reviewer that it is written in such a way as to be understandable to any intelligent person. SIDNEY CORNELL.

New Publications

BOOKS

NATIONAL SAFETY CODE FOR THE PROTECTION OF THE HEADS AND EYES OF INDUSTRIAL WORKERS. Bureau of Standards Handbook Series, No. 2. Price 10c.

"INDEX TO PROCEEDINGS" American Society for Testing Materials, Vols. 13 to 20 (1913 to 1920). Published by the society, 1315 Spruce St., Philadelphia, Pa. Price in cloth $2.50. 189 pages. Both subject matter and authors are indexed.

PAMPHLETS

"OPTICAL METHODS IN CONTROL AND RESEARCH LABORATORIES," by J. N. Goldsmith, S. Judd Lewis and F. Twyman, has been published by Adam Hilger, Ltd., 75A Camden Road, London, N. W. 1, England. This second edition is greatly enlarged, and forms a guide to applications and to the selection of apparatus. Price 1s. 8d.

RICHARDS & GEIER, patent and trademark attorneys, 277 Broadway, New York City, have recently published a third edition of their booklet on trademarks, which contains the salient features of the trademark law and practice. Copies of this booklet are available for gratuitous distribution to interested readers.

NEW U. S. GEOLOGICAL SURVEY PUBLICATIONS: I: 24, Gold, Silver, Copper, Lead and Zinc in Nevada in 1921, by V. C. Heikes (Mineral Resources of the U. S., 1921, Part I), published Feb. 10, 1923; I: 28, Gold, Silver, Copper, Lead and Zinc in Colorado in 1921, by Charles W. Henderson (Mineral Resources of the U. S., 1921, Part I), published March 16, 1923; I: 30, Iron Ore, Pig Iron and Steel, in 1921, by Ernest F. Burchard and Hubert W. Davis (Mineral Resources of the U. S., 1921, Part I), published April 23, 1923; II: 26, Sulphur and Pyrites in 1921, by H. A. C. Jenison and H. M. Meyer (Mineral Resources of the U. S., 1921, Part II), published Dec. 29, 1922; II: 27, Stone in 1921, by G. F. Lough-

lin and A. T. Coons (Mineral Resources of the U. S., 1921, Part II), published Jan. 22, 1923; II: 28, Cement in 1921, by Belle W. Bagley (Mineral Resources of the U. S., 1921, Part II), published Jan. 8, 1923; II: 29, Mineral Waters in 1921, by W. D. Collins (Mineral Resources of the U. S., 1921, Part II), published Feb. 5, 1923; II: 30, Natural-Gas Gasoline in 1921, by E. G. Sievers (Mineral Resources of the U. S., 1921, Part II), published Jan. 25, 1923.

NEW BUREAU OF STANDARDS PUBLICATIONS: Circ. 46, Testing of Barometers and Altimeters; Circ. 62, Soap; Circ. 73, Copper; Circ. 78, Solders for Aluminum; Circ. 81, Bibliography of Scientific Literature Relating to Helium; Circ. 98, U. S. Government Specification of Volatile Mineral Spirits for Thinning Paints; Sci. Paper 458, Apparatus for the Determination of the Magnetic Properties of Short Bars, by M. F. Fischer; Sci. Paper 463, Preparation and Properties of Pure Iron Alloys—II. Magnetic Properties of Iron-Carbon Alloys as Affected by Heat-Treatment and Carbon Content, by W. L. Cheney; No. 464, Preparation and Properties of Pure Iron Alloys—III. Effect of Manganese on the Structure of Alloys of the Iron-Carbon System, by Henry S. Rawdon and Frederick Sillers, Jr.; Sci. Paper 465, Composition, Purification, and Certain Constants of Ammonia, by E. C. McKelvy and C. S. Taylor; Sci. Paper 466, Wave Length Measurements in the Arc Spectra of Gadolinium and Dysprosium, by C. C. Kiess; Tech. Paper 227, American and English Ball Clays, by H. H. Sortwell; Tech. Paper 228, Lathe Breakdown Tests of Some Modern High-Speed Tool Steels, by H. J. French and Jerome Strauss; Tech. Paper 230, A Recording Chronograph for the Inverse Rate Method of Thermal Analysis, by H. J. French; Tech. Paper 231, Tentative Standard Test Methods and Percentages of Oil and Moisture in Hair Press Cloths, by F. R. McGowan and C. W. Schoffstall; Tech. Paper 232, Shellac, by Percy H. Walker and Lawrence L. Steele; Tech. Paper 234, Methods of Measuring the Plasticity of Clays, by F. P. Hall; Miscellaneous Publications, No. 2, The International Metric System of Weights and Measures.

Men in the Profession

Prof. HORACE G. BYERS, head of the department of chemistry, Cooper Union, N. Y., and president of the American Institute of Chemistry, sailed May 8 on the Mauretania for a 3 to 4 months trip to Belgium, France and Germany. The greater part of Dr. Byers' time will be spent on investigating the status of the chemical industry in Belgium and France.

G. W. CLAMER of the Ajax Metal Co., Philadelphia, has been elected president of the American Foundrymen's Association. H. B. SWAN of the Cadillac Motor Co. is the new vice-president.

H. C. DICKINSON, who has been for some time on leave of absence from the Bureau of Standards to serve as director of research of the Society of Automotive Engineers, has returned to the bureau. He resumes his work as physicist and has been designated chief of the heat division. Work of this division includes thermometry, pyrometry, automotive engine investigations and the various branches of research on thermal physics.

E. H. DIX, JR., who for the past few years has had charge of the metals branch of the engineering division, U. S. Army Air Service, at McCook Field, has resigned to take charge of the new metallurgical laboratory of the Research Bureau of the Aluminum Company of America, New Kensington, Pa. Mr. Dix has been working on the production of light alloys since his graduation. During the war he was in charge of the testing department of the general laboratories of the Bureau of Aircraft Production. At McCook Field he organized a most interesting foundry which operates under strict technical control, where is worked out the correct manufacturing practice for new and old alloys.

ECKARDT V. ESKESEN, head of the New Jersey Terra Cotta Co., New York, has been elected president of the National Terra Cotta Society, rather than vice-president as previously noted in these columns. O. W. KETCHEM of Philadelphia has been elected first vice-president and ADOLPH HOTTINGER second vice-president. WALTER GEER, JR., is treasurer and F. S. LAURENCE has been elected executive secretary.

Dr. E. C. FRANKLIN was guest of honor at a luncheon given by the Chicago Chemists Club, May 7.

CHARLES HINCHMAN has been elected vice-president of the Keystone Tire & Rubber Co., New York.

A. E. MARSHALL, chemical engineer, of Baltimore, Md., delivered a series of three lectures on chemical engineering to the department of chemical engineering, Columbia University, May 8, 9 and 10.

Prof. HARRY MCCORMACK of Armour Institute of Technology and Dr. GUSTAV EGLOFF of the Universal Oil Products Co. are in Washington, testifying in the patent interference case of Dubbs vs. Isom (Sinclair Refining Co.) in connection with oil cracking. Dr. Walter F. Rittman of the Carnegie Institute of Technology and Prof. Frank Wagner of Rose Polytechnic Institute have testified for the Sinclair Refining Co.

ROBERT A. MILLIKAN, foreign secretary of the National Academy of Sciences, returned to Pasadena, Calif., recently after having delivered several addresses before scientific organizations in the Eastern states.

HERBERT FISHER MOORE, first professor of engineering materials at the University of Illinois, gave an interesting illustrated address before the members of the Engineers' Club of the Lehigh Valley, Allentown, Pa., May 7, on the subject of the failure of materials caused by fatigue stresses.

Prof. A. A. NOYES recently underwent an operation at Johns Hopkins Hospital, Baltimore, to combat an infection in his larynx. He is reported to be convalescing satisfactorily.

FRANK REITH, formerly chief chemist at the plant of the Golden State Portland Cement Co., Oro Grande, Calif., has become connected in a similar capacity with the recently organized Cajon Lime Products Co., San Bernardino, Calif. He will also act as superintendent at the proposed plant of the new company.

R. C. TOLMAN, professor of physical chemistry and mathematical physics at the California Institute of Technology, has been elected a member of the National Academy of Sciences.

A. S. WALTER, professor of chemistry at the New Mexico School of Mines at Socorro, N. M., has been recently appointed professor of mining and metallurgy. Professor Walter has been identified with mining, milling and smelting in the West since 1907. He is the junior member of the firm R. J. Walter & A. S. Walter, consulting mining and metallurgical engineers, of Denver.

Society Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS will hold its ninth annual convention at Hotel Sherman, Chicago, June 4 to 9.

AMERICAN CHEMICAL SOCIETY will hold its fall meeting in Milwaukee, Wis., Sept. 10 to 14.

AMERICAN ELECTROPLATERS SOCIETY will hold its eleventh annual meeting at Providence, R. I., July 2 to 5.

AMERICAN GAS ASSOCIATION will hold its annual convention the week of Oct. 15 at Atlantic City. An elaborate exhibition of gas-making and gas-utilization equipment is planned.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS will hold its summer meeting June 20-23 at Wilmington, Del.

AMERICAN LEATHER CHEMISTS ASSOCIATION will hold its twentieth annual convention at the Greenbrier, White Sulphur Springs, W. Va., June 7, 8 and 9.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS will hold its spring meeting May 28 to 31 in Montreal, Canada.

AMERICAN SOCIETY FOR TESTING MATERIALS will hold its twenty-sixth annual meeting at the Chalfonte-Haddon Hall Hotel, Atlantic City, beginning Monday, June 25, 1923, and ending either Friday or Saturday of that week.

CANADIAN INSTITUTE OF CHEMISTRY will hold its annual meeting in Toronto, May 29 to 31.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (NINTH) will be held in New York Sept. 17-22.

NATIONAL FERTILIZER ASSOCIATION will hold its thirtieth annual convention at White Sulphur Springs, W. Va., the week of June 11.

NATIONAL LIME ASSOCIATION will hold its fifth annual convention at the Hotel Commodore, New York City, June 13 to 15.

NATIONAL SYMPOSIUM ON COLLOID CHEMISTRY will be held at the University of Wisconsin, June 12 to 15.

NEW JERSEY CHEMICAL SOCIETY holds a meeting at Stetters Restaurant, 842 Broad St., Newark, N. J., the second Monday of every month.

PACIFIC DIVISION, American Association for the advancement of Science, will hold its seventh annual meeting at the University of Southern California, Los Angeles, Sept. 17 to 20, in conjunction with the summer session of the national association and a meeting of the Southwestern Division of the National Association.

SOCIETY OF CHEMICAL INDUSTRY, Canadian Section, will meet in Toronto, May 29 to 31.

SOCIETY FOR STEEL TREATING — Eastern sectional meeting will be held June 14 and 15, in Bethlehem, Pa.

TAYLOR SOCIETY will hold a meeting June 7, 8 and 9 at the Hotel Onondaga, Syracuse, N. Y.

The following meeting is scheduled to be held in Rumford Hall, Chemists' Club, East 41st St., New York City: June 8—American Chemical Society, regular meeting.

Industry and Trade

Current News and Market Developments

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May 21, 1923

CHEMICAL & METALLURGICAL ENGINEERING

Tenth Avenue at 36th Street, New York

H. C. PARMELEE, *Editor*

Market Section

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The Summary of the Week

Four dye plants, backbone of German chemical trust, seized by French.

Harry A. Curtis to head Yale's chemical engineering department.

Richard B. Moore succeeded by Samuel C. Lind as chief chemist of Bureau of Mines.

Reports to Department of Commerce, from different foreign countries, say American exporters are neglecting the trade of markets abroad, because domestic markets are more attractive.

State Department announces method of procedure to be followed by importers who desire export licenses for shipping goods from the Ruhr.

Spanish decree of April 30 extends preferential import rates to commodities entering Spain from different American republics, but the decree does not extend to United States goods.

Collectors of customs have received instructions to exact penalties on importers who release goods from custody on bond in lieu of required shipping documents, whenever the missing papers are not presented within prescribed time limits.

Demand for calcium arsenate has quieted down following uncertainty in arsenic market, and prices are easier.

Recent advances in acetic acid have been followed by an advance of one-half cent per lb. in quotations for acetate of lead.

A sale of 700 tons of coconut oil in bulk at 8c. per lb. c.i.f. Pacific Coast, was reported. This is a new low price for the movement.

Lower prices have been announced for salicylates, but all producers have not met the decline and offerings do not appear free at the lower price levels.

Manufacturers Report on Business Conditions

AT the convention of the National Association of Manufacturers, held last week in New York, a very interesting report on general industrial conditions was submitted. This report deserves more than passing mention, including, as it does, production and consumption of basic materials in the representative industries of the country. The conclusions reached are in harmony with those which have been current in trade circles. The manner in which information has been sought and obtained is strikingly different from the ordinary and gives to the report of the association an authority that is beyond dispute. The report is based on a survey of the manufacturing trades in the leading industrial centers. This survey took the form of a questionnaire to which more than 42,000 answers were received, and from this abundance of first-hand information the conclusions of the report were drawn. While the questionnaire covered a wide range of industries, the information was grouped under key industries.

According to the survey, conditions in general throughout the country are very healthy and wholesome. A large number of replies from manufacturers characterized business as excellent and further stated that prospects for the fall trade were equally bright. Those who reported business as poor formed only a small fraction of 1 per cent of the number who answered in that way in the year preceding.

Production, as compared with last year, is showing an increase of something like 40 per cent in all lines of manufacture, with excellent prospects for fall. Stocks on hand are reported generally as low or normal, indicating that sales are keeping ahead of or abreast with production, another most healthy symptom. In New York, Massachusetts, Pennsylvania, Ohio, Illinois and Indiana, the reports of "excellent to fair" for present business and fall prospects in all lines rarely fall below an average of 99 per cent, while stocks are reported low to normal by about the same percentage of manufacturers.

Under the plan of grouping key industries, reports on activities in chemicals are joined with those for drugs, oils and paints. It is possible that unusual activity in some of these trades may bring up the average for the group, but at least an approximate idea of conditions existing in those industries may be gathered from the survey, which states that 95 per cent report present trade excellent to fair and fall prospects excellent to fair. Ninety-four per cent report business as better than last year and stocks on hand are normal or low in 88 per cent. Employment has increased in 93 per cent of the factories, while there is a labor shortage felt by 66 per cent. Wages have been increased in 75 per cent of the cases, while almost the same percentage report a production increase of about 37 per cent. Sales quantities have increased about 20 per cent in 70 per cent of the reporting factories, while their values have increased on the average of 14 per cent over the values of last year.

Important Changes in Personnel at Bureau of Mines

R. B. Moore Resigns as Chief Chemist and Chief Mineral Technologist to Be Succeeded by Samuel C. Lind

RICHARD B. MOORE, well known for his work as chief chemist of the United States Bureau of Mines, is resigning his post to take effect on June 1. He is to go into commercial work with the Dorr Co., engineers, of New York, where he is to be in charge of that company's development work and is to act as consulting engineer in certain of the company's projects. His resignation follows 11 years of service at the bureau. Dr. Samuel C. Lind is to be his successor.

Dr. Moore is 58 years old. His education has included work at University College, London, under Sir William Ramsay, a B.S. degree at Chicago University, from which institution he went to the University of Missouri as an instructor. In 1905 he became professor of chemistry at Butler College, Indianapolis, where he remained until 1911. In 1916 the University of Colorado bestowed on him the honorary degree of Doctor of Science. Perhaps his most notable work at the bureau has been in connection with the production and purification of the rare gases, especially helium.

Dr. Lind, who succeeds him, has also had very thorough training in scientific work and extensive experience in the work of the bureau. His education included study at Washington and Lee University, a degree at M.I.T., a Ph.D. from Leipzig, after which he worked at the University of Paris and the Radium Institute of Vienna. When he entered the Bureau of Mines as physical chemist, he was acting as assistant professor of chemistry at the University of Michigan. This was in 1912. Dr. Lind, at present, is in charge of the bureau's rare and precious metals experiment station, at Reno, Nev. His chief work has been on radio activity, radium extraction and measurements; the influence of radiation on chemical action; kinetics of chemical reaction; and the relations of gaseous ionization to chemical action. He is likewise the inventor of the well-known interchangeable electroscope which bears his name.

Photo by Harris & Ewing
SAMUEL C. LIND

Calendar

The following important technical meetings are scheduled for the immediate future:

AMER. SOCIETY MECHANICAL ENGRS.
Montreal, May 28-31

CANADIAN INSTITUTE OF CHEMISTRY
Toronto, May 29-31

SOCIETY OF CHEMICAL INDUSTRY
Canadian Section
Toronto, May 29-31

AMER. ASSN. CEREAL CHEMISTS
Chicago, June 4-9

AMER. LEATHER CHEMISTS ASSN.
White Sulphur Springs, W. Va., June 7-9

NAT'L FERTILIZER ASSOCIATION
White Sulphur Springs, W. Va., June 11-16

NATIONAL LIME ASSOCIATION
New York City, June 13-15

SOCIETY FOR STEEL TREATING
Eastern Sectional Meeting
Bethlehem, Pa., June 14-15

AMER. INST. CHEMICAL ENGRS.
Wilmington, Del., June 20-23

AMER. SOC. FOR TESTING MATERIALS
Atlantic City, June 25-29

France Seizes Four German Dye Plants

Outcome of Latest Move May Have Great Significance—I. G. Now Under French Control

France has taken a big bite into the "Interessengemeinshaft" (I. G.), or German chemical trust. Four of Germany's largest dye plants have been seized. These are said to represent from 50 to 90 per cent of the entire dye output of the trust. The numerous dispatches received from the Ruhr are somewhat conflicting in detail. It is not clear what disposition is to be made of the plants seized. One report states that the time of occupation will be only long enough to seize and remove available dyestuffs which are due France and Belgium. The New York *Tribune* states, however, that "the seized factories, in accordance with the terms of the treaty, will not be turned back to Germany until the default on dye payments has been cleared up through future negotiations—a development which by no means appears imminent."

The four plants that have been seized are the Badische Anilin und Soda Fabrik, near Ludwigshafen, said to employ 40,000 workers; the Kalle Chemical Works at Biberich-on-the-Rhine; the Hochster Farbwerke, formerly the Meister Lucius & Brüning concern; and the Weiler-ter-Meer works at Urdinge, near Duisberg. The laborers on duty at the plants were allowed to leave but none was allowed to enter.

Since Germany's attitude has been disclosed on the reparation settlements question, through the note of May 2, the French and Belgians are gradually tightening their grip on the occupied areas. If German labor is unavailable in the Ruhr, France hopes to make up the shortage by imported workmen. For several days past Italians have been entering the area in large numbers.

A.C.S. Invited to Washington

The Washington Chemical Society voted on May 10 to invite the American Chemical Society to hold its 1924 spring meeting in Washington. It is hoped that this session of the society can be made unusually successful because of the expected large attendance at so favorable a location. Since the society has received no other invitations for that meeting, it is expected by Washington chemists that this invitation will be accepted.

Anti-Dumping Order Issued

The Treasury Department has issued an anti-dumping order against calcium carbide imported from the province of Quebec, Canada, having received information that this product is being sold or is likely to be sold at less than its fair value, to the detriment of domestic producers. The duty on calcium carbide is 1 cent a pound. In accordance with the order under the 1921 anti-dumping law, collectors will assess additional duty on importations from Quebec sufficient to bring the total cost to a fair value.

Michigan to Have New Chemical Engineering Laboratory

With the opening of the fall term at the University of Michigan, that institution is to be equipped with its new engineering building, which will include one of the finest chemical engineering laboratories in the country. The equipment includes adequate experimental apparatus for work on evaporation, distillation, gas absorption, filtration, drying and cystallizing, as well as on stirring and mixing.

With its new facilities, the school is much better fitted for graduate work than it has been in the past. As a result several specialized groups of graduate courses are to be given, including gas engineering, metallurgy, organic industries, pulp and paper and general manufacturing.

Ford Buys Garnet Quarry

Henry Ford's latest purchase is a New Hampshire plant for the quarrying and finishing of garnet for use in the automobile manufacturing industry as a polishing agent.

Production of Carbon Black Becomes Political Issue in Louisiana

At Present Production Is Permitted Under Certain Regulations—Change in Administration May Ban Industry From the State

A GUBERNATORIAL CAMPAIGN is opening in Louisiana. One of the issues apparently is to be the attitude of the state toward the carbon black industry. The Monroe gas field in that state, described by the Bureau of Mines as the most extensive ever discovered in the country, now is the principal source of carbon black in the United States. The Monroe field is so isolated that no use has been found for this great gas supply other than the manufacture of carbon black, with its incidental recovery of gasoline and some small use for local fuel purposes. There has been much discussion of proposals to pipe this gas to New Orleans, but as the distance is in excess of 300 miles and the crossing of the Mississippi River is involved, the feasibility of the project has remained in sufficient doubt to prevent the financing of the project.

The present state administration in Louisiana instigated careful studies of the situation, to which the U. S. Geological Survey and the Bureau of Mines contributed importantly. As a result of those studies it was deemed best to permit the manufacture of carbon black under certain regulations. This policy now is being assailed and one of the candidates for Governor is expected to advocate that the industry be banned from the state.

It is declared that the fifteen carbon plants in the Monroe field are using 1,380,000,000 cu.ft. of gas a day. It is contended that the profits of these fifteen factories aggregate $3,000,000 a year, practically all of which goes out of the state. It is argued that the benefit to Louisiana from this industry is practically negligible and that on the other hand the extinction of the gas field is threatened.

The opposition to the manufacture of carbon black insists on basing its claims of inefficiency and waste on a quantitative standard. Sight is lost of the fact that carbon black is a complex and highly essential pigment, contributing perhaps as much to the pleasure and needs of the people in Louisiana through its use in the rubber, printing and other industries as it would were it made available to them in the form of fuel. Since the losses of long transmission would be great, the efficiency of Monroe field gas at the burner in New Orleans probably would not be much greater than that at the carbon black factories. Since the pipe line to New Orleans or other centers of population is still a vision and very likely never will be realized, the friends of the carbon black industry in Louisiana are pointing out that to ban that utilization of this resource would mean that no use whatever would be made of the gas. As the presence of gas is regarded as the best clue to the occurrence of oil, it is certain that active drilling in the field will continue. Under such conditions it never has been found practicable in any gas field to attempt to conserve the supply under ground awaiting the development of the so-called higher uses.

Strength in Paper Markets

Very firm conditions exist in the paper and pulp industry. A review of the industry by the American Paper and Pulp Association says that the paper manufacturers, in the face of the heaviest demand ever known in some branches of the industry, are not taking advantage of the increasing cost of raw materials and of labor to increase prices. In one important branch of the industry, for example, prices are 98 per cent higher than in 1914, but costs are 101 per cent higher.

The basic strength of the paper markets in general is indicated by the fact that there seems to be no speculative demand. The orders being received are strictly to meet pending requirements. Boxboard mills are sold ahead for three months, newsprint is in unprecedented demand, with prospects of still greater demand, orders for wrapping are in excess of production, and in such food-protective specialties as parchment and waxed paper deliveries are from three weeks to two months behind.

Increased Output of Acetate of Lime and Methanol

Production of acetate of lime in March was 15,569,000 lb., as compared with 13,894,000 lb. in February. For the first quarter of the year production was 46,007,000 lb., which compares with 44,471,000 lb. for the last quarter of 1922. These figures were compiled by the Department of Commerce, through the Bureau of the Census, in co-operation with the National Wood Chemical Association. Methanol production in March is placed at 91,273 gal., as against 85,105 gal. in February. For the first 3 months of the year the output of methanol reached a total of 2,498,134 gal., which represents an increase of 55,506 gal. over the production for the last quarter of 1922.

Final Program of A.I.C.E.

Local Committee of American Institute of Chemical Engineers Announces Technical Program and Social Features of Wilmington Meeting

THE fifteenth semi-annual meeting of the Institute will convene at the Hotel du Pont, Wilmington, Del., on June 20. Registration will begin at 8 a.m. and the technical program will follow closely. Four sessions of technical papers will include the following:

"Activated Carbon, Its Evaluation and Uses," Frederick Bonnet, Jr.

"The Properties of Activated Carbon Which Determine Its Industrial Applications," N. K. Chaney, A. B. Ray and Ancel St. John.

"The Abatement of Industrial Stenches by Activated Carbon," N. K. Chaney and A. B. Ray.

"The Capillary Theory of Adsorption From Solution With Silica Gel," W. A. Patrick.

"The Refining and Recovery of Petroleum Products by Silica Gel," E. B. Miller.

"Hydro-Electric Development in the Pacific Northwest," C. A. Newhall.

"Synthetic Ammonia From Byproduct Hydrogen," Charles O. Brown.

"Oxidation of NO to NO_2," W. A. Patrick.

"The Sulphur Industry," C. A. Newhall.

"Laboratory Corrosion Tests," W. S. Calcott and J. C. Whetzel.

"Materials of Construction for Chemical Apparatus," Harold F. Whittaker.

"Acid- and Abrasion-Resisting Metals and Materials," W. E. Piper.

"Modern Methods of Metal Protection and Finishing," L. E. Eckelmann.

"The Literature of Chemical Corrosion," A. E. Marshall.

"Action of Fullers Earth on Vegetable Oils," David Wesson.

"Automatic Fractionating Columns," W. A. Peters, Jr.

"The Rate of Absorption of Hydrochloric Acid Gas in the Tyler Vitreosil System," H. E. Fritz and James R. Withrow.

"The Theory of the Design and Testing of Gas Absorption Apparatus," E. M. Baker.

"Calculation of Vapor Recompression Evaporators," L. A. Pridgeon.

"Economic Value of Chemistry in Industry—A Study of the Census of Manufactures, 1919, and of Foreign Trade, 1921," R. K. Strong.

The members and guests of the Institute will be entertained at a reception given by Mr. and Mrs. C. L. Reese on Wednesday afternoon and at the theater in the evening. An opportunity for inspecting the conservatories of P. S. du Pont and a supper at the home of Irenee du Pont will be among the courtesies extended to the visitors.

Trips through the famous Jackson laboratories of the du Pont Co., the Jessup & Morse Paper Co., the Bond Corporation cork plant and the Joseph Bancroft cotton-finishing plant will be features of the technical program.

Washington News

Spain Excludes U. S. From Favored Import Rates

Cable advices from Commercial Attaché Cunningham at Madrid state that a Spanish decree of April 30 grants the benefit of preferential rates of the import tariff to Honduras, Hayti, Dominican Republic and Panama, thereby according them the same treatment as is given other American republics by previous legislation. The favored rates are not extended to include the United States, Canada and Brazil. According to unofficial advices from Spain, all goods from the United States imported into Spain after Nov. 5 will be subject to materially higher duties than are now in effect. Efforts are being made to procure an agreement whereby materials and manufactured goods from this country will be admitted into Spain on a more favorable basis, but the higher import duties on many materials originating in Spain, as put into effect by the new tariff act of this country, makes it improbable that our goods will be favored by Spanish import regulations.

United States Largest Buyer of Haitien Logwood

A report from Consul Damon C. Woods, covering the logwood industry in the Cape Haitien consular district, states that logwood held second place among the commodities exported from that district in 1922. In commenting on market conditions, the report states that logwood recovered appreciably from the depression of 1921, when the price fell to $15 per ton f.o.b. Cape Haitien, as contrasted with $40 in the summer of 1920. Of the total amount shipped in 1922, at least 90 per cent went to Newport News and Chester, Pa., for reduction into extract at the plants of large American dyewood concerns. This proportion amounted to 13,571 tons, of the declared value of $277,194.79, or an average of $17.42 per ton after deduction of the export duty of $3 per ton. Due to the lower freight rate nearly all of this logwood was carried on sailing vessels.

The logwood extract plant at Grand Riviere du Nord, in the Cape Haitien district, increased its output and exportation from 306,199 lb. of liquid extract in 1921 to 1,552,889 lb. in 1922. The declared value of the product for the latter year was $59,592. In addition the factory shipped 30,260 lb. of extract in crystallized form. The entire quantity went to the United States.

Declared exports from the three ports of the district to the United States, exclusive of returned American goods, for the years 1921 and 1922 were:

	1921		1922	
	Quality	Value	Quantity	Value
Logwood	10,047 tons	$238,148	13,571 tons	$277,194
Logwood extr. crystals			30,260 lb.	2,092
Logwood extr. liquid	306,199 lb.	17,836	1,552,889 lb.	59,592

Thomas W. Delahanty Joins Chemical Division

Thomas W. Delahanty, a chemical engineer of New York, who recently was appointed a member of the staff of the Chemical Division of the Department of Commerce, assumed his new duties May 14. The appointment is in line with plans to increase the staff of the division under C. C. Concannon, acting chief, to meet the demands of expanding work.

Mr. Delahanty is a Cornell graduate and a member of the American Chemical Society and of the American Society of Mechanical Engineers. During the war he was inspector of powder and explosives in the ordnance department of the army and later became Lieutenant in the navy air service in charge of hydrogen gas production at Rockaway Beach, N. Y. He has had considerable experience in manufacture, import and export of drugs, chemicals and dyes through his connection with Dicks David Co., Inc., and the American Chemical Co. He came to the Chemical Division from the Ajax Rubber Co., where he had been systematizing production, control and marketing of products.

Specific Penalties for Loss of Shipping Documents

Of interest to importers was the announcement of Assistant Secretary of the Treasury Moss, made last Wednesday, to the effect that new regulations would become effective with reference to the cancellation of bonds. This refers to bonds given by importers in cases where goods reach domestic markets and where shipping documents are missing or are incomplete. In such cases the consignee obtains possession by furnishing a bond to the collector of customs, in order to guarantee the later presentaton of the necessary documents. According to the new instructions, collectors of customs are advised, in treating bonds for the production of missing documents as satisfied, to demand and collect $20 for each missing invoice not produced within 6 months, and $10 for each missing declaration of the owner or ultimate consignee not produced within 90 days from the date of entry.

Also an amount equal to the invoice value plus the duty will be collected for failure to return to the collector on demand packages subject to redelivery.

Collectors may in their discretion waive demands for the payment of liquidated damages upon the non-production of other documents governing the importation and admission of merchandise into the commerce of the United States, but when demand is made in such cases no greater amount will be collected than $20 upon any one default of the bond, without specific authority of the department.

Unfavorable Outlook for Lower Freight Rates

Senators and Representatives who have been planning to make a drive at the next session of Congress for reduced freight rates are perturbed by the prospect that such agitation will not arouse any popular enthusiasm. When prices are good, the average shipper is more interested in service than he is in the rate. On most commodities the freight rate really represents a small percentage of the selling price. When prices are hovering around the cost of production, the freight charge looks big. For that reason the agitation of railroad legislation in 1921 and early in 1922 struck a popular chord. It is believed, however, that in prosperous times there will be no general support for any legislation that would instruct the Interstate Commerce Commission to regard an amount less than 6 per cent as a fair return or to take into account other factors which would have the effect of lowering rates.

Transportation specialists in Washington agree that more efficient service is being rendered by the railroads at this time than ever before has been the case. The proportion of unfilled car orders to the total loadings is very small. This has been made possible through closer co-operation and more friendly relationships with the shippers; through the reduction to the minimum of bad-order equipment, and through the placing in service of increasing numbers of new cars.

Personals

Leon Rigole, vice-president of the Société Co-operative Graines & Huiles, Antwerp, was in New York last week.

C. A. Mace, formerly with the Butterworth-Judson Corporation, is now associated with the Tower Manufacturing Co.

Colonel Charles B. Wing, prominent paper manufacturer, died at his home in Cincinnati on May 13.

J. W. Daniels, president of the new linseed oil combine, the Archer-Daniels-Midland Linseed Co., Minneapolis, was in New York last week. According to G. H. Tomlinson, who is in charge of the New York office of the old Midland Linseed Products Co., the sales policy will not be altered in any way, and the production of "Midland" brand oil will be marketed through his office as heretofore.

F. C. Ryan, Eastern sales manager of the Shasta Zinc Co., left New York last week on a business trip, to include points in the Middle West.

American Exporters Urged to Retain Trade of Foreign Markets

Business With Markets Abroad Being Neglected, According to Reports Received by Department of Commerce

AFTER having captured a considerable foreign trade, American manufacturers are allowing it to get away from them while they cater to the domestic market, which for the nonce is more attractive. Reports to the Department of Commerce from a large number of countries indicate that American exporters are neglecting their foreign business. Since the war upset the world's trade, the American exporter has been playing the flirt with foreign markets, as one official described it. For a time every attention will be given a foreign buyer and then without warning he will be jilted. It is feared that many markets will be lost irretrievably to the United States if the present tendency continues.

Largely as a result of fortuitous circumstance, the United States has built up an important foreign business. While favorable conditions were responsible for inducing American manufacturers to go into foreign markets, their activities in that connection represent a large investment. Not only is this investment being jeopardized by the present business policies of many exporters, but it is sealing the way against any retracing of steps when the domestic demand begins to fall off.

Officials of the Department of Commerce are urging that a fair distribution of available stocks be made among all customers. If there is to be any favoritism shown, it should be in favor of the foreign market. American consumers, once that they understand the situation, would be willing to make some sacrifice in order that foreign trade may be retained.

American manufacturers and exporters, it is pointed out, would be well advised in taking a leaf from the German book. Germany, and to a less extent England, fill foreign orders first. They are in a position to satisfy later their domestic customers if they should be displeased in securing delivery. Concrete information is at hand from a hundred sources to indicate that foreign markets are being neglected. It applies to all lines and is not confined to the chemical trade. The situation is regarded at the Department of Commerce as being of sufficient seriousness to require the most energetic efforts to remedy the situation while there still is time.

Curtis to Direct Chemical Engineering at Yale

Harry A. Curtis, now in charge of the Department of Commerce's nitrate investigation, has been appointed professor of chemical engineering at Yale University. He will undertake his new work at New Haven early in the fall, taking charge of the course in chemical engineering which was established by Yale about 3 years ago.

The work in chemical engineering at this institution is to be developed in close co-operation with both the chemistry and the engineering departments. Details of the plans for the department and the course of study will be prepared during the next few months to permit their application during the next college year. As head of the department Curtis will be active in both the scientific and technical faculties.

The nitrate study on which he is now engaged will be actively prosecuted by Dr. Curtis during the summer and probably will continue to receive his attention in a consulting capacity until this part of the government's raw materials survey has been completed.

Dr. Curtis was graduated from the University of Colorado in chemical engineering and taught there for several years prior to 1917. He received the Ph.D. degree in chemistry at the University of Wisconsin and somewhat later was for a short time professor of chemistry at Northwestern University. For 2 years he was in government work, first as a Captain in the Ordnance Department and later as executive officer of the Fixed Nitrogen Research Laboratory, Washington. In this War Department work he was active in the design and operation of the small-scale ammonia-oxidation plant at Sheffield, Ala. More recently he has been chief chemist of the International Coal Products Co., first being in charge of research and development work at Irvington, N. J., and subsequently serving as general manager of the Clinchfield Carbocoal Corporation, South Clinchfield, Va., an International subsidiary.

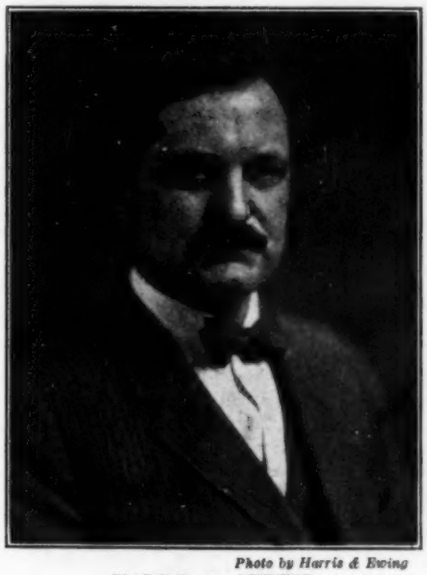


Photo by Harris & Ewing

HARRY A. CURTIS

News Notes

The California Section of the A.C.S. continues to provide excellent addresses at its monthly meetings. On May 11 Prof. James Kendall of Columbia gave an illustrated talk on "The Separation of Isotopes."

"The Andrew Carnegie Chair of Biochemistry" is the name assigned to the chair of biochemistry at the University of Cincinnati, according to an announcement made by Judge Rufus B. Smith, chairman of the board of trustees. With the expansion of the biochemistry department at the University of Cincinnati it is expected that Cincinnati will become the center for the study of various branches of chemistry.

A new chemical laboratory at Tufts College, Mass., comprising a large three-story and basement building, is practically completed, and arrangements are being made to dedicate the structure with appropriate ceremonies on alumni day, June 16.

Oats won't produce alcohol, although sugar can be obtained in large quantities by hydrolysis of hulls. The Forest Products Laboratory has made this finding as a result of special experiment. It is thought that this conclusion confirms the belief that many cellulosic substances which have been considered as possible sources of alcohol are actually not suitable for its production.

The second annual fertilizer conference to be held by the Connecticut Agricultural College is planned for July 11 and 12. This conference is intended primarily for manufacturers and dealers. However, several papers of interest to the consumer as well as to these groups are included in the program.

Cleveland and Akron chemists are planning a big day for May 23, when the Cleveland Chapter of the A.C.S. holds its spring meeting. During the day several Cleveland plants are to be visited and in the evening Charles L. Parsons, H. E. Howe and H. H. Dow, president of the Dow Chemical Co., are to address the society.

Non-Shellac phonograph records of simple materials and inexpensive fabrication have been developed by European manufacturers. The new process, using paper, cloth or leather as a base instead of requiring molding, makes use of rotary presses capable of turning out 50,000 per unit per day. The unit mold's capacity has been about 600 per day. Production of the new records is to begin here in the near future.

Liquid oxygen can be used to advantage in lessening blasting costs in iron, salt and other mineral mines and quarries. This explosive also has several further advantages, according to the Pittsburgh experiment station of the Bureau of Mines and $15,000 for further investigation of this use of oxygen has been appropriated for use during the coming fiscal year.

American Buyers of Goods in the Ruhr May Obtain Export License

New Regulations Define How Applications Must Be Made—German Firms Authorized to Make Deliveries on Sales Made Prior to Feb. 20

LAST Wednesday the Department of State issued a statement, in which was outlined the method to be followed by American importers, in securing deliveries of goods which they had purchased from the Ruhr section of Germany. The statement sets forth that the method of procedure in securing export licenses is not as simple as it is desired, but represents such concessions as have been granted to date on the part of the German authorities and from the occupying forces. It is held that American buyers will receive considerable relief by observing these regulations and directions.

"American buyers intending to apply for export licenses for goods in occupied Germany must address their applications to the Rhineland High Commission at Coblenz, stating the date of contract, quantity and character of goods, the value of order, name of German supplier and submit evidence showing that contract was made prior to Feb. 1 and that payment has been made either in whole or in part. A copy of the contract should accompany the application.

"However, the authorities in occupation stipulate that applications must be accompanied by a statement covering the American interest in the shipment. Accordingly, until further notice, American buyers should first submit the application direct to the American Embassy in Paris or Brussels, which will issue the statement required and forward it with the application to the American Consul at Coblenz, who in turn will present the application to the High Commission for approval. When the application is returned, the Consul will, upon request, turn it over to the American buyer's agent or representative, who should then make all arrangements with appropriate licensing office for delivery of the license and payment of export tax, to the authorities in occupation.

"The department is informed that the authorities in occupation on May 1 put into force an export tariff based on the German export tariff of 1921 instead of the 10 per cent ad valorem tax which has been temporarily collected and, furthermore, that the time for receiving applications from American buyers for contracts made previously to Feb. 1 has been extended for an indefinite period. However, American buyers are urged to expedite their applications as much as possible. The department also understands that German firms are now authorized by their government to deliver goods involved in commercial transactions made prior to Feb. 20, provided they have first obtained a German export license.

"In negotiating, on behalf of American commerce, with the various governments concerned in this matter, it has been the aim of the Department of State to endeavor to obtain for American traders the same facilities granted to traders of other countries and at the same time to find a way out of the present deadlock of commerce, whereby, through the modification of conflicting regulations and the elimination as far as possible of official interference, the movement of American-owned goods for export out of occupied Germany could actually be accomplished."

Federal Specification Board Officials Named

Dr. George K. Burgess, new director of the Bureau of Standards, has been named by the President as chairman of the Federal Specification Board. In this office he succeeds S. W. Stratton, formerly director of the bureau.

N. F. Harriman, who has been acting chairman during the interim, is named as vice-chairman and technical secretary of the board, in charge of all administrative and routine matters and supervision of technical committee work. Mr. Harriman is located at the Bureau of Standards.

Manganese Exports From Brazil

Total exports of manganese from Brazil in 1922 were 340,706 tons, an increase in quantity over 1921 exports and a decrease as compared with 1920, according to a report from Commercial Attaché W. L. Schurz at Rio de Janeiro. Heavy exports were made to the United States, the message states.

Figures on total manganese exports for 5 years, in gross tons, with the average price per ton are given as follows:

1922, 340,706 tons, $65; 1921, 275,694 tons, $83; 1920, 453,737 tons, $88; 1919, 205,725 tons, $82; 1913, 122,300 tons, $22.

Quiet Market for Fertilizers in France

The French fertilizer market is calm, according to a cable from Commercial Attaché Jones to the Department of Commerce dated May 13. April deliveries of nitrate of soda were 53,000 tons, imports were 37,000 tons and stocks on hand 20,000 tons. Little business is being done in other fertilizers. The price of turpentine fell to 600 francs, the market being unsettled. Raw materials of naval stores are being gathered.

Trade Notes

Stocks of flaxseed at Minneapolis on May 12 were placed at 10,263 bu., which compares with 6,885 bu. the week previous and 69,829 bu. on the corresponding date a year ago.

The Department of Commerce announces that the value of products of establishments engaged primarily in the distillation of common or ethyl alcohol and other liquors, whether sold as such for industrial or medicinal use, or in a denatured form, amounted to $28,789,000 in 1921, as compared with $31,854,000 in 1919, a decrease of about 10 per cent.

The Endicott-Johnson Corporation officials have been in St. Louis inspecting various properties with a view to locating a large warehouse there.

The M. S. Chemical & Drug Co. of Brooklyn, N. Y., has increased its capital stock from $5,000 to $250,000.

The Archer-Daniels Linseed Co., 29th Ave., Minneapolis, Minn., manufacturer of oil products, has been reorganized as the Archer-Daniels-Midland Co. A charter has been taken out under Delaware laws with capital of $10,625,000, and plans are in progress for general expansion in plant facilities for the production of vegetable oils.

Governor Gifford Pinchot of Pennsylvania has signed a bill recently passed by the Legislature, regulating the sale of caustic acid, alkali and chemical or mineral preparations designed for domestic or agricultural service. The bill requires that all containers used for such materials be labeled with the name and address of the manufacturer, and the word "poison."

The Rubber Controller for Ceylon has announced that a maximum of 36,020 long tons of Ceylon-produced rubber may be exported from Ceylon during the year Nov. 1, 1922, to Oct. 31, 1923.

The steamship "West Prospect" arrived at San Francisco on May 14, from Manila, with a cargo of 2.259 tons of copra.

E. Bright Wilson has been appointed equity receiver for the Druggists' Commercial Alliance, Inc., 250 Hudson St., New York, in an action filed by the Mifflin Chemical Corporation.

Officials of the International Paper Co. have denied reports that the company is involved in negotiations for a merger with Canadian interests which would combine a half dozen plants operating on the St. Maurice River near Quebec.

Bush, Beach & Gent, Ltd., of London, announces that the company is now entirely British owned. It is removing shortly to larger offices at 24 Monument St., London, E. C. 3.

White Arsenic Makes Gold Mining Profitable

New Plant Treating Gold-Bearing Concentrate at Montana Mine Yields 100 Tons of As_2O_3 Per Month—Sold at 14½c. Per Lb., f.o.b. New Jersey

ON APRIL 15 the Jardine Mining Co. removed 75 tons of crude oxide of arsenic from the kitchens of its newly built plant at Jardine, Mont. This was the first product from the plant, which had been in operation for about 30 days. The mines of the Jardine company are on the edge of Yellowstone National Park, 6 miles from Gardiner, the nearest railroad point. They have been worked for gold for many years. The ore is low grade, however, and the recent demand for arsenic offered a welcome opportunity to realize a profit from the large content of arsenopyrite in the gold ores.

The special correspondent of *Engineering and Mining Journal-Press* in that vicinity reports that as a consequence of the high price of arsenic, plans were made in December, 1922, to treat the concentrate and recover the arsenic at the mill. Fortunately, the large mill building formerly used as a cyanide plant was in good condition. A few tanks were removed, the building was remodeled, and the new equipment was rapidly installed. A reverberatory furnace, connected with a dust chamber, and a series of kitchens 6x8 ft. in section and 180 ft. long, were built. These were connected to a large stack, the top of which is 250 ft. higher than the furnace. Construction work was finished and the plant was operating on March 17, just 2 months from time it was started. The cost of plant, including building alteration and equipment, was $12,000.

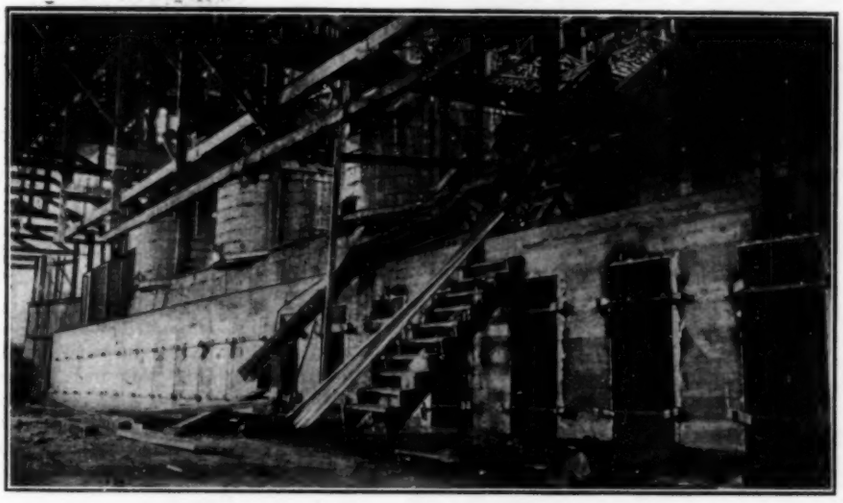
The first time the concentrates are treated the reverberatory furnace is fired with ordinary mine-run coal. The arsenic volatilizes and the fume is conducted through the dust chamber and thence to the baffled kitchens, where the arsenious oxide is deposited. This product is not white; accordingly it is stored until enough has been accumulated for refining. It is then put through the same process except that a coke fire is used in the reverberatory instead of a coal fire.

The concentrate as received from the mill averages 38 per cent arsenic and contains from 2 to 3 oz. in gold per ton. At the present time the capacity of the arsenic plant is limited to 100 tons of oxide per month.

Shipped to New Jersey

The first car of calcined concentrates was shipped from Gardiner on March 29 to the East Helena smelter. The first shipment of refined white arsenic was contracted for by W. F. B. Berger, representing the Chipman Chemical Engineering Co. The price agreed upon was reported to have been 14½c. per lb. f.o.b. Bound Brook, N. J.

The large smelting companies have been producing white arsenic as a by-product for years, but this is probably the first venture at producing it as on a commercial scale by an independent mining company.



ARSENIC KITCHENS BUILT IN THE OLD CYANIDE PLANT AT THE JARDINE MINE

Leather Chemists to Meet at White Sulphur, W. Va.

The convention of the American Leather Chemists which is to be held at White Sulphur, W. Va., June 7-9 is to include features which will be of great interest. These embrace a wide field, including among others two papers on chrome tanning, one on tannin and several on the use of oil in leather fabrication. Dr. Allan Rogers will give a unique talk, illustrated by moving pictures, on leathers of marine origin. F. M. Moffat, president of the Tanners' Council, plans to be present to address the association.

Advisory Committee Expanded for 1923 Exposition

Chemical Exposition plans are being formulated for the 1923 show, which is to be held at Grand Central Palace, New York, during the week of Sept. 17 to 22, inclusive.

The advisory committee which aided in conducting last year's exposition has been expanded, and in addition to the former twenty executives and technical men now includes the following members from the sales and production departments of the chemical and chemical equipment manufacturers: John W. Boyer, of the Mathieson Alkali Works; Dr. Charles L. Reese, of E. I. du Pont de Nemours & Co.; Percy D. Schenk, of the Duriron Co.; Milton Kutz, of the Roessler & Hasslacher Chemical Co.; W. E. Moore, of the New Jersey Zinc Co.; T. C. Oliver, of the Chemical Construction Co.; R. Gordon Walker, of the Oliver Continuous Filter Co.; Williams Haynes, of *Drug and Chemical Markets;* H. J. Schnell, of the *Oil, Paint and Drug Reporter.*

Alabama Exporting Large Amounts of Pitch

According to advices coming from Birmingham, Ala., a number of plants in that section are selling pitch in large quantities to European governments and private firms. One company at Ensley is reported to have closed.

The Semet-Solvay Co. of Ensley has just closed a deal with the Italian Government for 5,113 tons of pitch for $60,000. This is but a small part of a movement of pitch that has been going to Europe during the past few months. In all it is estimated that from 40,000 to 50,000 tons has been shipped to Europe since Jan. 1, 1923.

About 35,000 tons of pitch had been accumulated by another company. All of this has been shipped to France, Italy and other countries, having been sold mostly in 5,000-ton lots.

Before the world war much pitch was shipped from the Birmingham district to European countries. During the war the shipments ceased. It has only been since Jan. 1 of the present year that these shipments have been revived. During the war piles of pitch at a number of plants at Bessemer and Fairfield grew very large, and it is out of these piles that many shipments have been made.

European manufacturers are using this pitch in making briquets, which are burned as fuel and are very valuable where coal is scarce or high.

One large producer has recently perfected a high-grade coke, which is manufactured out of this pitch by putting it through a beehive coke oven. This gives a coke of 98 per cent pure carbon, and sells for several dollars more per ton than ordinary coke.

It is estimated that from now on Birmingham pitch will continue to move to Europe at the rate of from 6,000 to 8,000 tons per month, even after the present accumulation is exhausted.

Facts and Figures That Influence Trade in Chemical Products

Market Conditions

Current Prices
Imports and Exports
The Trend of Business

Prices for Chemicals Continue to Show Downward Tendency

Arsenic and Calcium Arsenate Sell at Lower Levels—Imported Copper Sulphate Weak—Prussiates Inactive and Decline in Price—Permanganate of Potash Lower—Denatured Alcohol Advanced in Price—Acetate of Lead Higher

THE market for chemicals was easier during the week. A few items, notably acetate of lead and alcohol, were marked up in price, and many of the important chemicals held a steady position, yet the general tone as a whole was easier. Imported materials have led the way in the downward movement and are relatively weaker than chemicals of domestic origin. In part this is due to lack of confidence in the position of foreign and in part to arrivals from abroad at a time when buyers were not prominent with the consequent result that prices were lowered to move stocks and thus avoid carrying charges. There seems to be a hesitancy on the part of consumers to take on fresh commitments and the market is not in a position to encourage speculative buying from non-consumers. Basically many selections are in a firm position but the influence of foreign markets and the attitude of buyers is expected to be a prominent factor in regulating values.

Arsenic holds a very prominent place in the present market. Views regarding prices for the next three months vary with well posted members of the trade holding that declines will be maintained only if imported makes come on the market in large volume. Estimates on domestic production of arsenic have been lowered but this has very little bearing on the market for nearby positions. It is evident, however, that demand has fallen off with the coming of lower prices and the same holds true for calcium arsenate.

Buying of caustic soda for export has ceased to be active and reports are heard that prices would have to be lowered materially to meet the views of foreign markets. As a result prices f.a.s. New York are easy and concessions could be obtained if actual business was in sight. On the other hand bichromates are firmly held and production has been reduced due to scarcity of labor. Most of the acids likewise are firm with some selections sold ahead and very little to be had in the open market.

The prospect of securing chemicals from the Ruhr, that is on purchases made prior to Feb. 1 and possibly to Feb. 20, were brighter as the result of an announcement from the Department of State that arrangements had been made with the authorities in Germany and with the authorities of the occupying forces, whereby shipments would be made, if a prescribed method of procedure were followed in securing export licenses.

Acids

Acetic Acid—Consuming demand is variously reported but in general new business appears to be along quiet lines, with export slowed up by the high prices in effect. Some of the largest consumers are covered by contracts placed at prices below those now quoted in the open market. Current quotations are on a basis of 3.38c. per lb. for 28 per cent and 6.75c. per lb. for 56 per cent. On glacial prices vary according to seller with round lots quoted at 12c. to 12.78c. per lb.

Boric Acid—Sellers are reported to be competing keenly for business and values have not reacted from the recent decline. Increased output also is credited as being a factor. Offerings are available at 10½c. per lb., in bbl. and 11½c. per lb., in kegs.

Chromic Acid—Steadiness in price has been the outstanding feature to this acid for a long time. Consuming interest is sufficient to prevent accumulations, without causing any upset to values. The technical grade is held at 39c. per lb., in drums and 98 per cent at 40c. per lb.

Citric Acid—Reports from foreign markets still indicate firm prices abroad and this has a steadying influence on the market in general. Spot holdings, however, have been subject to some fluctuations according to seller with offerings heard at 51½c. to 52½c. per lb. Domestic goods holds at 49@50c. per lb. with offerings fairly ample.

Lactic Acid—Imported offerings are said to be in poor demand with prices largely nominal. Home makes are finding a good outlet in consuming trades with prices on a steady basis of 5½@6c. per lb. for 22 per cent light and 4½@5c. per lb. for 22 per cent dark.

Muriatic Acid—Producers are still well sold ahead and the scarcity of stocks gives a strong tone to the market. Good call is reported for contract deliveries and this leaves but little to be had on new accounts. Quotations are given at 90c. to $1 per 100 lb. for 18 deg. and $1.75@$2 per 100 lb. for 22 deg.

Oxalic Acid—Prices for domestic remain firm at 13½c. per lb., f.o.b. works with smaller lots commanding higher prices. Demand, while not active, has been fairly good. Imported is not in large supply but prices do not appear steady and sellers are open to bids with 13½c. per lb. given as representing the market.

Tartaric Acid—Imported was easier in tone and 36¾@37c. per lb. was quoted for prompt. Trading was not active. Domestic grades are moving regularly against contracts with very little offered in the open market. Prices for the latter hold at 37½c. per lb.

Potash

Bichromate of Potash—The general asking price of producers is 11½c. per lb., f.o.b. works, although some makers are willing to deliver at that price in places near by works. There has been a fair call for moderate sized lots and with an absence of competitive selling, values are well maintained.

Caustic Potash—Sales of domestic have been made at 9c. per lb., works, and this is the inside price heard for such offerings. Imported sold at 7½c. per lb. early last week, and eagerness of holders to move stocks gave a weak appearance to the market. As low priced stocks were reduced, prices recovered slightly and 7¾c. per lb. was asked for spot and shipment. In fact shipment was quoted up to 8c. per lb. and prices depended on seller.

Carbonate of Potash—Stocks of 90-95 per cent are still held in the local market, with prices low in comparison with quotations for lower grade material. It was possible to do 6½c. per lb. For 80-85 per cent asking prices were 7c. per lb., with a possibility that 6¾c. per lb. could be done. Hydrated was in fair demand at 7½@7¾c. per lb.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	177.66
Last week	177.69
May, 1918	270.00
May, 1919	248.00
May, 1920 (high)	280.00
May, 1921 (low)	143.00
May, 1922	159.00

An easier situation in spot barium chloride brought down the week's index number 3 points. The major items in the list scarcely moved so far as prices were concerned.

Chlorate of Potash—Offerings of imported chlorate could be picked up at 7½c. per lb. and attempts to advance prices resulted in withdrawal of buyers. There is a steady movement of domestic with the price holding steady at an inside figure of 8½c. per lb., works, for powdered or crystal.

Permanganate of Potash — Lower prices have prevailed in this market and the impression is gaining that still lower prices are to follow. The general asking price for spot material was 19c. per lb. Consumers are slow to take hold and prices for shipment are purely nominal, as no interest was taken in forward positions. Some consumers say that a 14c. per lb. level will be reached before the decline will be checked.

Prussiate of Potash—While 70c. per lb. was asked for red prussiate, it was difficult to interest buyers at that figure and on firm bids it was reported that 68c. per lb. would find sellers. Yellow prussiate likewise was easier and 36c. per lb. was given as the price at which sales were made.

Sodas

Soda Ash—The market is quiet as far as new business is concerned but contract withdrawals are holding up well and this is absorbing a large part of production. Prices are holding on a steady basis with quotations for light ash at $1.20 per 100 lb. in bags, carlots at works and $1.40 per 100 lb. in bbl. These are contract prices and on new orders for prompt shipment a slight advance is asked. Dealers have quoted as low as $1.75 per 100 lb., with a range upward on a quantity basis.

Bichromate of Soda—Underlying conditions have not changed for the better, and prominent producers are holding out for 8½c. per lb. at works. The spot market is quiet but 8½c. per lb. is asked, and while reports are still heard to the effect that odd lots can be picked up at 8½c. per lb., this is by no means an open quotation.

Caustic Soda—The falling off in export buying has had a dampening effect on prices, in spite of attempts of producers to maintain values. Shipments to foreign markets are noted against old orders, but demand for June forward is very dull and according to reports $3.25c. per lb. could be done on some makes, although prices are generally quoted at 3.30@3.35c. per lb., according to brand and seller. Domestic consumption is fairly large, based on the movement from producing points. Quotations for domestic use are 2½c. per lb., basis 60 per cent, carlots, f.o.b. works. Spot offerings are held at an inside price of 3½c. per lb., with the usual range for smaller amounts.

Fluoride of Soda — The advance in price of a short time ago served to restrict trading, and values have eased off both on the part of imported and domestic grades. Freight rates play an important part in dividing demand for the two grades, with imported cheaper along Atlantic coast points. Prices for imported are 9@9½c. per lb., while domestic is held at 10½c. per lb. and upward on a quantity basis.

Nitrate of Soda—The announcement of a new schedule of prices for shipments from Chile, as reported last week, has had no influence as a market factor. In the spot market $2.60 per 100 lb. is given as the asking price, but resale offerings are rather numerous, especially at southern points, and this causes some shading. Interest is not keen either for spot or shipment. The new prices are on a basis of $2.45 per 100 lb. for July, August and September; $2.47½ per 100 lb. for October; $2.50 per 100 lb. for November; $2.52½ per 100 lb. for December; $2.55 per 100 lb. for January; $2.60 per 100 lb. for February; $2.62½ per 100 lb. for March to June inclusive. Estimates on consumption of nitrate for the year, to end June 30, place the total in excess of 2,100,000 tons and the visible supply is placed at 1,150,000 tons.

Prussiate of Soda—A buyers' market has prevailed with prices weak. Spot holdings have shown wide fluctuations, according to seller. Some reports credit sales at 16½c. per lb. and up to 17½c. per lb. is asked. Buyers are interested only when concessions are granted and slow consuming demand is largely responsible for the present weakness. Imported for shipment is quoted at 16½@17c. per lb., with prominent domestic producers not yet ready to quote on anything but May deliveries.

Miscellaneous Chemicals

Acetate of Lime—Reports on production show that the domestic output for the first quarter of the year was larger than for the last quarter of 1922. The position of raw materials, however, is firm and the higher selling price recently inaugurated is being adhered to. Asking prices are 4@4.05c. per lb.

Arsenic—Demand for white arsenic is none too active. The fact that some domestic producers are supplying consumers at prices under those quoted in the open market is taking away interest in imported grades. It is generally held however that prices will hold fairly steady for the present unless imports become larger than is now expected. Some producers have offered prompt shipment at 13½c. per lb., but there were offerings of prompt from Canada at 13c. per lb. with June shipment at the same price. For June, domestic material is offered at 12½c. per lb. In the spot market prices ranged from 14½c. to 15c. per lb., but it was difficult to arouse interest at those levels. Some reports say that sales for delivery into 1924 have been made at 9c. per lb., but other reports say there is no interest in distant positions.

Calcium Arsenate — Buying interest has become less active and consumers evidently are influenced by the lower prices which have come out recently for arsenic. Sales of calcium arsenate are reported to have gone through at 16c. per lb. although 17c. per lb. is the figure asked in many quarters. A considerable quantity of arsenate was damaged by fire last week but this had nothing more than a passing effect on the market.

Copper Oxide—Demand has been active throughout the season and stocks have been held at low levels. Some producers are using their entire output to take care of contract deliveries and are unable to quote for nearby shipment. With offerings difficult to locate, prices are little better than nominal with prices of 20@21c. per lb. heard as representing sellers views.

Copper Sulphate — Domestic makes are offered at 6c. per lb. for large crystals and 5.90c. per lb. for small crystals. Demand is reported to be fair but not active. Imported grades were very weak and sales are said to have been made at 5½c. per lb. The lower prices have not succeeded in stimulating business to any marked degree and the trend of values is uncertain, depending on the volume of imports.

Cream of Tartar—Domestic makers held out for 26½c. per lb., while on the imported there were sellers down to 25½c. Demand showed no improvement, and, despite the recent uplift in the acid, prices were rather unsettled in some directions.

Lead Acetate—With the seasonable demand about to come in producers of lead acetate advanced the market ½c. per lb. The revised trading basis follows: White crystals, bbl., 14@14½c.; white, broken, 13½@14c.; white granular, 13¾@14¼c.; brown, broken, 13@13½c. per lb. Less than a fortnight ago there was much talk of a higher market, but the weakness in the metal held prices in check. The higher cost of acetic acid was one of the reasons given out for the uplift in prices.

Tin Oxide—The market for tin suffered another decline, but late in the week the metal developed a firmer tendency and producers of tin oxide saw no good reason for lowering prices. Up to the close 50c. represented the general asking price.

Denatured Alcohol Up

Leading producers of denatured alcohol announced an advance of 2c. per gal. on all grades. Demand was described as fair, but with competition not so keen, the market presented a better feeling from the seller's point of view. The No. 1 special closed at 35c. per gal. in drums, and 41c. per gal. in barrels, carload lots. Completely denatured, 188 proof, formular No. 1, was raised to 43c. per gal. in drums, and 49c. per gal. in barrels. Ethyl spirits closed unchanged on the basis of $4.70 per gal. for the 190 proof, U. S. P. Methanol also was unchanged, first-hands quoting on the basis of $1.18 on the 95 per cent. Production of methanol in March was placed at 831,784 gal., against 733,179 gal. in February and 933,171 gal. in January.

Coal-Tar Products

Competition in Salicylates Unsettles Prices—Spot Phenol Quiet—Flake Naphthalene Sells at 9c. on Spot; Crude Easier

AT THE close of the week prices named for the salicylates showed a wide range. The decline in the market was not general, several large factors refusing to meet the cut announced early last week and, according to some traders, it was not possible to purchase round lots at the lower levels in all instances. Talk in the trade had it that a "price war" was the cause of the sudden shift in the position of certain makers. With no important change in the market for phenol, traders seemed to be at a loss for any other reason for the decline. Of course, there is a possibility that, with demand less active and prospects for cheaper phenol in sight, producers who led in the decline saw no good reason for maintaining prices any longer.

The reported seizure by the French of several large German coal-tar products plants attracted attention in trade circles here, but in the absence of more definite information operators suspended judgment. With sufficient tariff protection manufacturers in this country are no longer so anxious about developments abroad. It is pointed out that the American coal-tar products industry has made rapid strides toward recovery from the severe slump witnessed about 2 years ago.

Importations of naphthalene continue, but virtually all of the crude arriving is moving into manufacturing channels. New prices on domestic ball and flake naphthalene have not yet been named. Spot flake was barely steady. Phenol settled at 54@55c. on spot, with trading quiet all week. Benzene in other than motor grades appeared in largest supply, but prices showed no quotable change.

Benzene—Reports on the state of trade were rather conflicting last week. Several handlers took the stand that business was not so good as at this time last year, yet prices pointed to a fairly steady market. Sales of the 90 per cent grade, for prompt shipment, went through at 30c. per gal., carload lots, in drums. Leading factors say that there is no accumulation in stocks of motor benzene and that indications point toward a steady market for some time to come.

Creosote—Another bulk shipment of creosote oil arrived from abroad consigned to wood preservative plants. What really interested traders was the receipt of several shipments of creosote oil fit for disinfectant manufacture. The market for the 25 per cent grade held at 30c. per gal. in tanks and 35c. per gal. in drums.

Cresylic Acid—The demand was inactive and prices were unsettled, imported 97 per cent, pale, being available at $1.25@$1.30 per gal., in drums, while on the 95 per cent, dark, there were sellers at $1.15 per gal. Domestic production has been augmented, but actual offerings remain light owing to the sold-up condition of leading makers.

Naphthalene—During the past week 1,440 bags of crude naphthalene arrived at New York, mostly from German ports. The market for crude was easier and nominal quotations on fair quality goods ranged from 3¼@3½c. per lb. c.i.f. New York. Flake on spot sold at 9c. per lb. On ball naphthalene the "outside" market held at 9¼@9¾c. per lb. There was no buying interest in futures.

Phenol—Scattered lots of U.S.P. phenol sold on spot at 54@55c. per lb. The demand was slow all week and the undertone was barely steady. With the trade talking increased production, buyers were disposed to hold off. Leading makers quote around 27@28c. on contract.

Salicylic Acid—A quotation of 40c. per lb. was named in more than one direction, but this failed to bring out a general downward revision in prices. In fact the largest producer refused to shade 50c. per lb. The keen competition among certain producers of salicylates, which has unsettled the market in all directions, had also curtailed buying. The revised list of prices, announced by several factors within the past week, follows: Sodium salicylate, U.S.P., 47c.; acid salicylic, U.S.P., 40c.; acid acetylsalicylic, U.S.P., 95c.; salol, U.S.P., 85c. Methyl salicylate was unchanged at 62c. per lb.

Beta Naphthol—Producers continue to quote the market on the 23c. per lb. basis, but in outside channels price cutting is being resorted to.

Aniline Oil—The market was steady at the close at 16c. per lb., round-lot basis, prompt shipment.

Xylene—First hands were sellers on contract at 75c. per gal. for the pure, but had little to offer. Second hands continue to quote around $1 per gal., spot.

Financial Notes

The annual report of the Anton Jurgens' United Margarine Works of Holland shows net income in 1922 of $8,931,723, leaving a balance of $1,446,223 after payment of all interest and full dividends on preference shares.

The Beech-Nut Packing Co. for the first 3 months of 1923 reports net earnings of $595,737 after all charges, but before providing for Federal taxes. This compares with net earnings of $392,291 in the same period last year.

A readjustment of capital of the St. Louis Coke & Chemical Co. of St. Louis has been completed. The reorganized company will be called the St. Louis Coke & Iron Co.

The Vacuum Oil Co. has declared a semi-annual dividend of $1 a share on the new $25 par stock, payable June 20 to stock of record May 31. This is equal to 32 per cent on the old stock of $100 par. Last year 16 per cent was declared on $100 par stock.

An addition of $75,000,000 to its authorized capital stock, increasing it from $225,000,000 to $300,000,000, has been proposed by the Standard Oil Co. of New York.

Income account of Devoe & Raynolds Co., Inc., for the year ended Dec. 31, shows net profits of $704,995, after charges, depreciation, and taxes. Consolidated income account for the year shows net sales of $10,077,924; cost of sales, $6,147,393; operating profit, $3,930,531, and total income, $4,007,134.

The Kennecott Copper Corporation for the first quarter of 1923 reports total income of $4,963,453 and net income of $4,395,203 after allowing for interest obligations totaling $568,250. Net income for the first quarter of the year was equal to $1.56 a share on the outstanding capital stock, against 28 cents a share earned in the last quarter of 1922.

Latest Quotations on Industrial Stocks

	Last Week	This Week
Air Reduction	67	64⅝
Allied Chem. & Dye	69¼	67
Allied Chem. & Dye, pfd	110¼	110
Am. Ag. Chem.	25	18
Am. Ag. Chem., pfd.	46½	43
American Cotton Oil	12¼	9¼
American Cotton Oil, pfd.	25½	19¾
Am. Drug Synd.	5⅝	5¼
Am. Linseed Co.	28⅜	27½
Am. Linseed Co., pfd.	48	46½
Am. Smelting & Refining	60⅜	56
Am. Smelting & Refining, pfd.	98¾	96½
Archer-Daniels Mid. Co., w.i.	39	38½
Atlas Powder	175	172
Atlas Powder, pfd.	87½	90
Casein Co. of Am.	*60	*60
Certain-Teed Products	39	38½
Commercial Solvents A	28	28
Corn Products	131½	131
Corn Products, pfd.	117½	116½
Davison Chem.	27¾	27
Dow Chem.	40½	...
Du Pont de Nemours	140	131
Du Pont de Nemours, db	87½	86
Freeport-Texas Sulphur	15⅝	15
Glidden Co.	9	9
Grasselli Chem.	130	130
Grasselli Chem., pfd.	102	*103
Hercules Powder	*107	105
Hercules Powder, pfd.	*102½	103
Heyden Chem.	1⅝	1⅞
Int'l Ag. Chem. Co.	7	3
Int'l Ag. Chem. Co., pfd.	29	25
Int'l Nickel	14¼	14¼
Int'l Nickel, pfd.	78	78
Int'l Salt	*90	*90
Mathieson Alkali	49¾	43
Merck & Co.	86	85
National Lead	122½	118¾
National Lead, pfd.	112½	112½
New Jersey Zinc	165	163
Parke, Davis & Co.	79½	81
Pennsylvania Salt	92½	89
Procter & Gamble	*140	*140
Sherwin-Williams	*29⅝	*29½
Sherwin-Williams, pfd.	*101	*101
Tenn. Copper & Chem.	10½	10¼
Union Carbide	61	61
United Drug.	80½	80
U. S. Ind. Alcohol	58½	56½
Va.-Car. Chem. Co.	13½	11½
Va.-Car. Chem. Co., pfd.	39½	37

*Nominal. Other quotations based on last sale.

Vegetable Oils and Fats

Coconut Weak on Selling Pressure—Linseed Futures Unsettled—Cottonseed Steadies—China Wood Lower—Tallow 7½c.

INQUIRY for vegetable oils in the edible group showed moderate improvement, but this could not be said of the technical descriptions. Prices were unsettled and declines were registered in coconut, corn, china wood and palm oils. Cottonseed, both crude and refined, steadied on smaller offerings, reflecting a tight statistical position on old crop oil. The break in tallow prices was a feature in the week's developments. Linseed oil was dull and sentiment favored buyers. Soya bean oil was barely steady. Olive oil foots was unsettled on lack of demand.

Linseed—Spot oil sold at $1.14 per gal., carlots, cooperage included, indicating that crushers were not in a hurry to lower prices. On June deliveries, however, business was booked at $1.09 per gal., cooperage terms, while on July oil nominal prices ranged from $1.03@$1.05 per gal. The forward positions were unsettled throughout the week, and some consumers, who have lost confidence in the market, resold contracts at sharp concessions. Crushers admitted that July-August-September oil might have been obtained at less than $1 per gal. on a firm bid. Demand, taken as a whole, was quiet. Foreign oil was offered freely on spot and sales went through at prices ranging from $1@$1.06 per gal., duty paid. The cost of import was high towards the close and May shipment from abroad settled around $1.06@$1.08 per gal., duty paid, landed weights, New York. Importations of flaxseed from the Argantine have been heavy. Crushers have virtually caught up on contract deliveries, but have not yet had an opportunity to accumulate a surplus in either seed or oil. Foreign crushers believe that the future of the market hinges upon the state of trade in America. Continued heavy absorption of oil by consumers in this country would tend to steady the seed situation. The acreage planted to flaxseed in the United States will have some bearing on the market, and from latest reports a fair increase in the plantings may be expected. The Argentine seed movement continues large, while Indian shipments have been in excess of 500,000 bu. weekly for some time now. Linseed cake for export was dull and prices nominal at $34.50@$35.50 per ton, f.a.s. New York.

Cottonseed — Prices did not move much one way or the other, but a steadier undertone was in evidence, reflecting apprehension over the tight statistical position and the improvement in lard and other speculative markets. Shorts were the buyers of May oil in the option market on the Produce Exchange and business went through at higher than 11½c. per lb., in prime summer yellow. The December option settled around 8¾c. per lb., but interest in the distant months was of a desultory character. Refiners' brokers were credited with buying July and September oil, at least part of which represented covering. Cotton prices did better on unfavorable weather news from the south, which also exerted some influence on oil. The Chicago lard stocks on May 15 were estimated at 30,455,152 lb., against 34,212,572 lb. on the first of the month, the shrinkage causing considerable surprise in the oil trade. Crude oil held at 9¾@10c. per lb., f.o.b mills, with offerings scanty. Bleachable oil was offered at 10¾c. per lb., f.o.b. Texas points. Lard compound held at 13@13¼c., f.o.b. New York. Oleo stearine was dull at 10c. nominal.

China Wood Oil—The market was weak, May delivery at New York selling at 25c. per lb., while June-July brought 23c. per lb. Demand was quiet and prices easy, even at the decline.

Coconut Oil—The sale of 700 tons of Manila oil at 8c. coast, bulk basis, was reported last week. Selling pressure was in evidence on the coast and on tank car offerings, nearby oil, prices ranged 8¼@8¾c. In New York the feeling was not so bearish and the price on Ceylon type oil in sellers' tanks settled at 8⅝@8¾c., according to position. Copra was offered at 5¼@5⅝c., c.i.f. New York.

Corn Oil—Crude was lowered to 9¼@9¾c., sellers' tanks, f.o.b. point of production.

Olive Oil — Denatured closed unchanged at $1.10@$1.15 per gal., in barrels, spot. Prime green sulphur oil (foots) closed barely steady at 9¼@9⅝c. per lb., spot New York, with demand quiet.

Palm Oil—The decline in tallow restricted buying in palm oils to a minimum and prices at the close were more or less nominal. Lagos was offered at 7¾c., spot, one parcel of 200 tons being available at this figure.

Soya Bean Oil—Crude soya was offered at 10¼c., coast, and 10½c. New York, sellers' tanks, duty paid, nearby positions. Demand was dull. One car of spot oil was offered at 10¾c., Atlantic port.

Fish Oils—No sales went through in crude menhaden oil. The nominal quotation on forward material held at 50c. per gal., tanks, f.o.b. factory. Newfoundland cod oil held at 70@72c. per gal., f.o.b. New York.

Tallow and Greases—The sales of several hundred drums of extra tallow went through at 7¼c. per lb., f.o.b. plant, a decline of ¼c. for the week. At the weekly London auction prices were unchanged. House grease was offered at 6¾@7c. per lb., according to acidity.

London Tallow Auction

At the weekly tallow auction, held in London, May 16, 731 casks were offered and 644 casks sold. Prices realized were unchanged.

Miscellaneous Materials

Casein—Arrivals from foreign sources were heavy, amounting to 4,870 bags. Offerings increased and the market presented an unsettled appearance. Prices named on the ordinary grades ranged from 20@25c. per lb., depending upon the quantity and seller.

Glycerine — While refiners did not alter prices for the c.p. grade, holding out for 17¼c. asked, in drums, it was intimated that certain operators took on business at 17c., drums included. Trading was inactive. Chicago quoted 17c. as the market for c.p. Dynamite glycerine sold late in the week at 16c. per lb., carload lots, drums included, a decline of ¼c. from the nominal price of a week ago. Demand for dynamite glycerine was quiet. Crude soap lye, basis 80 per cent, loose, held at 11¼c. asked, eastern territory, while in the Middle West 11c. represented the nominal asking price. On saponification, 88 per cent, loose, 12¼c. was asked, with no transactions to report.

Turpentine—Inquiry from foreign as well as domestic buyers sent prices sharply higher and late in the week the nominal quotation stood at $1.22½ per gal., which compares with $1.08, the recent low. Southern markets developed strength and this stimulated buying interest. However, after the rise the demand met with a setback.

Shellac—Cables were about unchanged and importers continued to offer T. N. on spot at 64@66c. per lb. Bleached, bonedry, held at 76@78c. per lb. Superfine orange was available at 68@70c. per lb. Trading was inactive.

White Lead — Corroders considered changing prices, but at the last minute it was decided upon to maintain the list on the basis of 9¾c. per lb. for the standard dry, in cask, round-lots. The pig lead market seemed to steady and this checked the easier undertone for the time being. Pig lead was unchanged at 7¼c., New York.

Zinc Oxide—New business was routine only, but deliveries against existing contracts absorbed the bulk of the production and leading producers reported a steady situation. Production of tires has not yet been restricted to the point where zinc oxide business is likely to suffer. American process, lead free, held at 8@8¼c. per lb. French process, red seal, closed unchanged at 9¾c. per lb.

Argentine Linseed Exports

Shipments of linseed from the Argentine from Jan. 1, 1923, to May 12, 1923, by countries, were:

	Bushels
United Kingdom	2,120,000
Continent	8,920,000
United States	13,128,000
To order	4,868,000
Total	29,036,000

The visible supply at the Argentine ports on May 12 was estimated at 4,000,000 bushels. The shipments to-date exceed all previous shipments for a like period.

Imports at the Port of New York

May 11 to May 17.

ACIDS—240 bbl. tartaric, Genoa, L. Appula Soc. Ind. Chimica Ital; 120 bbl. tartaric, Bremen, Warren Products Co.; 25 dr. cresylic, Rotterdam, Shipping & Coal Co.; 30 dr. cresylic, Rotterdam, Order; 46 bbl. oxalic, R. W. Greeff & Co.; 20 csk. tartaric, Liverpool, Order; 91 dr. cresylic, Liverpool, Order; 400 bbl. tartaric, Genoa, L. Oppuia Soc. An.

ALCOHOL—28 bbl. denatured, Arecibo, M. Feigel & Bros.; 174 bbl. do., Arecibo, C. Esteves; 32 bbl., Piraeus, Order; 103 csk. butyl, Bordeaux, Commercial Solvents Corp.; 52 bbl. denatured, Arecibo, C. Estevas; 28 bbl. do., Arecibo, M. Feigel.

ALIZARINE—5 csk., Liverpool, A. Klipstein & Co.; 7 csk., Hamburg, Kuttroff, Pickhardt & Co.; 4 csk., Hamburg, Regal Color & Chem. Co.; 4 pkg., Hamburg, Grasselli Chem. Co.; 3 csk., Hamburg, Guaranty Trust Co.

ANTIMONY OXIDE—50 pkg., Changsha, Order.

ARCHIL LIQUOR—19 csk., Liverpool, H. Kohnstamm & Co.

ARGOLS—352 bg., Lisbon, C. Pfizer & Co.; 142 csk., Messina, Tartar Chem. Wks.; 275 bg., Rotterdam, C. Pfizer & Co.; 115 csk., Naples, Tartar Chem. Works.

ARSENIC—396 cs., Kobe, P. E. Falkingham; 160 cs., Kobe, China-Am. Tobacco & Trading Co.; 250 cs., Kobe, Mitsui & Co.; 115 cs., Kobe, Frazer & Co.; 200 csk., Hamburg, A. Klipstein & Co.; 50 csk., Hamburg, Ore & Chemical Corp.; 150 cs., Hamburg, Order; 25 csk., Genoa, Guaranty Trust Co.; 87 csk., Antwerp, Chem. Nat'l Bank; 159 csk., Antwerp, Order; 44 csk., Bordeaux, Order.

AMMONIUM—10 csk. carbonate, Liverpool, Order; 8 csk. sulphocyanide, Liverpool, Order; 1183 csk. nitrate, Hamburg, Kuttroff, Pickhardt & Co.

ASBESTOS—950 bg., Southampton, W. D. Crumpton & Co.

BARIUM HYDRATE—21 csk., Hamburg, E. Suter & Co.

BARIUM SUPEROXIDE—68 bbl. Hamburg, F. Boehm.

BARIUM PEROXIDE—99 csk., Hamburg, W. A. Brown & Co.; 62 dr., Havre, Mallinckrodt Chem. Wks.; 124 dr., Havre, Gulf Merc. Corp.

BARYTES—600 bg., Bremen, N. Y. Trust Co.; 599 bg., Bremen, Order; 17 csk., Hamburg, Order.

BARIUM CHLORIDE—52 csk., Antwerp, Order.

CAMPHOR—100 cs., Kobe, Nat'l Park Bank; 200 cs., Kobe, Mitsui & Co.; 56 cs., Shanghai, Eastman Kodak Co.; 100 cs., Hamburg, A. Ochse Co.

CASEIN—667 bg., Buenos Aires, Equitable Trust Co.; 84 bg., Buenos Aires, Nat'l City Bank; 417 bg., Buenos Aires, Williamson Trading Co.; 2002 bg., Buenos Aires, Kalbfleisch Corp.; 100 bg., London, A. Hurst & Co.; 250 bg., Bordeaux, N. Y. Trust Co.; 100 bg., Bordeaux, Nat'l City Bank; 833 bg., Buenos Aires, Equitable Trust Co.; 417 bg., Buenos Aires, Irving Bank-Col. Trust Co.

CREOSOTE—6015 tons, Antwerp, American Creosoting Co.; 60 dr., Leith, Order.

CHEMICALS—46 csk., Hamburg, Roessler & Hasslacher Chem. Co.; 93 pkg., Bremen, Pfaltz & Bauer; 7 cs., Antwerp, Ciba Co.; 157 pkg., Rotterdam, Order; 149 pkg., Antwerp, Order; 63 bbl. Hamburg, Roessler & Hasslacher Chem. Co.; 242 pkg., Hamburg, Jungmann & Co.

CHALK—500 tons, London, Baring Bros. & Co.; 3,000 bg., Antwerp, Bankers Trust Co.; 2,200 bg., Antwerp, Irving Bank-Col. Trust Co.; 2,000 bg., Antwerp, Order; 1,828 tons (bulk), Dunkirk, Taintor Trading Co.; 500 tons (bulk), Dunkirk, J. Higman.

COLORS—63 csk., Havre, Ciba Co.; 58 csk. aniline, Havre, Sandoz Chem. Works; 2 csk. do., Havre, Order; 24 pkg., Hamburg, Kuttroff, Pickhardt & Co.; 20 pkg., Hamburg, Grasselli Chem. Co.; 19 cs. dry, Bremen, M. G. Lange & Co.; 5 keg. aniline, Antwerp, Am. Ex. Nat'l Bank; 16 pkg., aniline, Antwerp, Irving Bank-Col. Trust Co.; 4 csk., Antwerp, Order; 8 csk. dry, Southampton, Order; 14 pkg. aniline, Havre, Sandoz Chem. Wks.; 1 pkg., aniline, Rotterdam, Am. Aniline Products, Inc.; 11 csk. and 1 cs., Rotterdam, B. Mernard; 8 pkg., Rotterdam, F. Donders; 3 csk., Rotterdam, Order; 162 pkg. earth, Leghorn, Reichard-Coulston, Inc.; 65 csk. ochre, Marseilles, Gledhill & Co.; 6 dr. aniline, Liverpool, Am. Exchange Nat'l Bank; 12 csk. earth, Hamburg, E. M. & F. Waldo; 26 csk. earth, Hamburg, J. H. Furman Co.; 50 csk. do., Hamburg, C. J. Osborn & Co.; 37 csk. ochre, Bordeaux, Butcher & Co.; 10 csk. aniline, Hamburg, Guaranty Trust Co.; 13 csk., Hamburg, H. A. Metz & Co.; 7 cs. aniline, Hamburg, Carbic Color & Chem. Co.

COPPER SULPHATE—156 csk., Hamburg, A. Klipstein & Co.

COPRA—21,444 bg., Cebu, Order.

CREAM TARTAR—40 bbl., Genoa, Order; 40 csk., Bordeaux, National City Bank.

DIVI-DIVI—769 bg., Monte Cristi, M. J. Petit.

EPSOM SALT — 500 bbl., Hamburg, Hansa Co.

FERTILIZER—2,500 bg. bonemeal, Karachi, Ralli Bros.

FLUORSPAR—975 bg., Hamburg, H. Sundheimer; 400 bg., Hamburg, A. Klipstein & Co.

FULLERS EARTH—950 bg., London, L. A. Salomon & Bros.

FUSEL OIL—12 csk., Antwerp, Guaranty Trust Co.; 8 csk., Hamburg, A. Klipstein & Co.; 6 dr., Hamburg, Order; 68 bbl. and 13 dr., Hamburg, Order; 9 csk., Genoa, Maas & Waldstein; 5 dr., Dunkirk, Maas & Waldstein; 10 dr., Dunkirk, Guaranty Trust Co.; 3 dr., Dunkirk, Order.

GAMBIER—498 cs., Singapcre, Order.

GLAUBERS SALT—278 bg., Hamburg, Roessler & Hasslacher Chem. Co.

GLYCERINE—6 dr., Liverpool, Br. Am. Tobacco Co.; 20 csk., Marseilles, Order; 41 dr., Antwerp, N. Y. Trust Co.; 40 csk., Nazaire, Marx & Rawolle.

GUMS—100 cs. damar, Padang, Order; 370 pkg. copal, Macassar, Brown Bros. & Co.; 1,200 pkg. do., Macassar, Kidder, Peabody & Co.; 3,855 pkg. do., Macassar, Order; 250 bg. arabic, Port Sudan, Thurston & Braidich; 250 bg. arabic, Port Sudan, T. M. Duche & Sons; 500 bg. arabic, Port Sudan, Caraconda Bros.; 250 bg. arabic, Port Sudan, W. Tappenbeck; 200 pkg. damar, Batavia, W. H. Muller & Co.; 155 pkg. copal, Singapore, Irving Bank-Col. Trust Co.; 350 bg. damar, Singapore, Kidder, Peabody & Co.; 255 bg. do., Singapore, Baring Bros. & Co.; 140 bg. damar, Singapore, Order; 901 pkg. copal, Macassar, Nat'l City Bank; 553 pkg. copal, Macassar, Order; 810 pkg. copal, Brown Bros. & Co.; 72 pkg. copal, Macassar, Irving Bank-Col. Trust Co.; 5,191 pkg. copal, Macassar, Order; 3,103 pkg. copal, Antwerp, Order; 530 bg. copal, Antwerp, Order; 125 bg. copal, London, Chem. Nat'l Bank.

IRON OXIDE—100 bbl. Malaga, Scott, Libby & Co.; 95 bbl., Malaga, J. L. Smith & Co.; 91 bbl., Malaga, Reichard-Coulston, Inc.; 81 bbl., Malaga, Order; 86 bbl., Malaga, S. C. Goldberg; 298 bbl. Malaga, C. K. Williams & Co.; 111 bbl., Malaga, Reichard-Coulston, Inc.; 125 bbl., Malaga, E. M. & F. Waldo; 303 bbl., Malaga, C. J. Osborne & Co.; 114 bbl., Malaga, Hummel & Robinson Co.; 17 csk., Liverpool, E. M. & F. Waldo; 39 csk., Hull, J. L. Smith & Co.; 40 csk., Liverpool, J. A. McNulty; 15 csk., Liverpool, Order; 25 csk., Manchester, Order; 25 csk., Leith, Reichard-Coulston, Inc.

IRON SULPHATE—88 csk., Antwerp, E. M. Sergeant & Co.

LITHOPONE — 200 csk., Antwerp, A. Klipstein & Co.; 999 csk., Antwerp, Benj. Moore & Co.; 80 csk., Antwerp, E. M. & F. Waldo.

MAGNESITE—250 bg. calcined, Rotterdam, H. J. Baker & Bro.; 105 bg. do., Rotterdam, Speiden.

MAGNESIUM—40 cs. carbonate, Hull, Van Oppen & Co.; 61 dr. chloride, Hamburg, Innis, Speiden & Co.; 345 bbl. chloride, Hamburg, Hansa Co.; 182 dr. chloride, Hamburg, Innis, Speiden & Co.

MANGROVE BARK—1,500 bg. extract, Singapore, Order.

MYROBALANS—1,824 pkts. Calcutta, Nat'l City Bank; 10,263 pkts., Calcutta, Order.

NAPHTHALENE—328 bg., Hamburg, Irving Nat'l Bank; 218 bg., Hamburg, Irving Bank-Col. Trust Co.; 294 bg., Hamburg, Calco Chem. Co.; 500 bg., London; Order.

OILS — **Castor** — 55 bbl., Hull, Brown Bros. & Co.; 200 bbl., Hull, Order. **Cod**—160 bbl., Hull, Order; 100 bbl., Hamburg, Order. **China Wood**—152 bbl., Hankow, Int'l Banking Corp.; 109 csk., Hamburg, Order. **Linseed**—146 bbl., London, Order; 146 bbl., London, Irving Bank-Col. Trust Co.; 120 bbl., Rotterdam, I. R. Boody & Co.; 1157 bbl., Rotterdam, L. & E. Frankel; 291 bbl., Rotterdam, J. C. Francesconi Co.; 146 bbl., Rotterdam W. Benkert Co.; 144 bbl., Rotterdam, Bur-Mac Chem. Corp.; 371 bbl., Rotterdam, Order; 1019 bbl., Hull, Nat'l City Bank; 800 tons in bulk, Hull, Am. Linseed Co.; 450 bbl., Hull, Order; 725 bbl., Copenhagen, Order; 770 tons, Leith Midland Linseed Products Co. **Olive Oil Foots**—(sulphur oil)—500 bbl., Naples, Brewer & Co.; 200 bbl., Messina, Bank of the Manhattan Co.; 200 bbl., Messina, First Nat'l Bank of Phila.; 100 bbl., Palermo, Banca Comm. Ital.; 100 bbl., Malaga, Elbert & Co.; 400 bbl., Syracuse, Order; 200 bbl., Catania, Mech. & Metals Nat'l Bank; 200 bbl., Catania, Order; 200 bbl., Milazzo, Order. **Palm**—499 csk., Seccondee, Order; 48 pkg., Liverpool, D. Bacon; 474 csk., Liverpool, African & Eastern Trading Corp.; 69 csk., Liverpool, Order. **Rapeseed**—1144 bbl., Liverpool, Vacuum Oil Co.; 200 bbl., Hull, Nat'l City Bank; 335 bbl., Hull, Order; 75 bbl., Leith, Order. **Sesame**—144 csk., Rotterdam, Order.

OIL SEEDS—**Castor**—1844 bg., Santos, F. Matarazzo & Co.; 373 bg., Santos, Bank of N. Y. & Trust Co.; 4400 bg., Santos, F. Matarazzo & Co. **Linseed**—87,350 bg., Rosario, Spencer Kellogg & Sons; 17,676 bg., Buenos Aires, Spencer Kellogg & Sons; 60,957 bg., Diamante, Order; 8,502 bg., Bajada Grande, Order; 26,407 bg., Buenos Aires, Order; 8,827 bg., Buenos Aires, L. Dreyfus & Co.; 6,088 bg., Buenos Aires, Order; 17,858 bg., Buenos Aires, L. Dreyfus & Co.; 24,090 bg., Buenos Aires, Am. Linseed Co.; 51,014 bg., Buenos Aires, Order.

POTASSIUM SALTS — 100 bbl., bicarbonate, Hamburg, Brown Bros. & Co.; 449 csk., nitrate, Hamburg, Kuttroff, Pickhardt & Co.; 34 dr., caustic, Bremen, Brown Bros. & Co.; 14 csk., carbonate, Bremen, P. H. Petry & Co.; 2,000 bg., sulphate, Bremen, A. Vogel; 30 dr., permanganate, Hamburg, E. E. Reifenberg; 581 dr., caustic, Hamburg, A. Klipstein & Co.; 37 dr., caustic, Hamburg, Order; 424 dr., permanganate, Hamburg, Order; 2,625 bg., muriate, Antwerp, Societe Comm. des Potasses D'Alsace; A quantity of Kainit, Antwerp, Societe Comm. des Potasses D'Alsace; 62 csk., carbonate, Hamburg, Innis, Speiden & Co.; 400 pkg., salts, Hamburg, Roessler & Hasslacher Chem. Co.; 21 csk., carbohydrate, Hamburg, Globe Shipping Co.; 200 bbl., bicarbonate, Hamburg, Mallinekredt Chem. Works; 100 cs. alum, Hamburg, Order.

PITCH—767 bbl., Hull, Order.

QUEBRACHO—2,017 bg., Buenos Aires, Guaranty Trust Co.; 6,128 bg., Buenos Aires, Nat'l Bank of Commerce; 6,955 bg., Buenos Aires, Order; 937 bg., Buenos Aires, Nat'l Bank of Comm.; 21,025 pcs., Santa Fe, Tannin Corp.; 6,000 bg., extract, Buenos Aires, Tannin Corp.; 10,075 bg., extract, Buenos Aires, Tannin Corp.; 4,100 bg., Buenos Aires, Fourth Atl. Nat'l Bank of Boston.

QUICKSILVER—100 flasks, London, A. Pickering & Co.

SHELLAC — 40 cs., London, Mech. & Metals Nat'l Bk.; 100 bg., London, Order; 300 bg., Calcutta, Brown Bros. & Co.; 520 bg., Calcutta, Bank of Br. West Africa; 350 pkg., Calcutta, Irving Bank-Col. Trust Co.; 200 bg., Calcutta, Br. Bank of South America; 150 bg., Calcutta, Chase Nat'l Bank; 600 bg., refuse lac, Calcutta, Bank of the Manhattan Co.; 50 cs., Calcutta, First Fed. For. B'k'g Corp.; 10 bg., Calcutta, Phil. Nat'l Bank; 3,429 bg., 200 chests, 338 pkg., button, 200 pkg., garnet, 75 cs., seed, and 40 bg., refuse, Calcutta. Order; 13 chests button, Hamburg, A. Helmrath.

SODIUM, SALTS — 1845 bg. nitrate, Mejillones, Wessel, Duval & Co.; 9,857 bg. nitrate, Iquique, Wessel, Duval & Co.; 15 csk. carbonate, Liverpool, J. Turner & Co.; 119 csk. sulphide, Hamburg, A. Klipstein & Co.; 109 dr. sulphide, Hamburg, Order; 10 csk. hyposulphite, Hamburg, Kuttroff, Pickhardt & Co.; 268 dr. sulphohydrate, Hamburg, C. S. Grant & Co.

SUMAC—700 bg., Palermo, Order.

STRONTIUM NITRATE—38 csk., Hamburg, Meteor Products Co.

TALC—700 bg., Genoa, C. Mathieu; 200 bg., Genoa, Kountze Bros.; 450 bg., Genoa, Parfume de Luxe Co.; 200 bg., Genoa, Order; 1,000 bg., Genoa, Ital. Discount & Trust Co.

TANNIN—12 csk., Antwerp, Geigy Co.

TARTAR—58 bg., Malaga, Tartar Chem. Works.

TALLOW—414 csk., Buenos Aires, Nat'l City Bank; 162 csk., Buenos Aires, Swift & Co.; 286 tcs., Buenos Aires, Nat'l City Bank.

WATTLE BARK—1,824 bg., Durban, E. J. Haley, Inc.; 11,659 bg., Durban, Tannin Corp.; 2,592 bg., Durban, Order.

WAXES — 113 bg. bees, San Antonio, Equitable Trust Co.; 36 bg. do, Valparaiso, W. R. Grace & Co.; 175 bg. do, Valparaiso, Banco Anglo Sud. Am.; 51 bg. bees, San Antonio Guaranty Trust Co.; 314 bg. bees, Lisbon Order; 36 bg. bees, Valparaiso, Guaranty Trust Co.; 332 bg. carnauba, Santos, F. Matarazzo & Co.; 26 bg. bees, Rio de Janeiro, Order.

ZINC CHLORIDE — 37 dr., Hamburg, Innis, Speiden & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetic anhydride, 85%, drums	lb.	$0.38 –	....
Acetone, drums	lb.	.25 –	.25½
Acid, acetic, 28%, bbl.	100 lb.	3.38 –	3.50
Acetic, 56%, bbl.	100 lb.	6.75 –	7.00
Glacial, 99½%, bbl.	100 lb.	12.00 –	12.50
Boric, bbl.	lb.	.10½–	....
Citric, kegs	lb.	.49 –	.52
Formic, 85%	lb.	.14 –	.16
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.12 –	.12½
Lactic, 44%, tech., light, bbl.	lb.	.11½–	.12
22% tech., light, bbl.	lb.	.05½–	.06
Muriatic, 18° tanks	100 lb.	.90 –	1.00
Muriatic, 20°, tanks,	100 lb.	1.00 –	1.10
Nitric, 36°, carboys	lb.	.04½–	.05
Nitric, 42°, carboys	lb.	.06 –	.06½
Oleum, 20%, tanks	ton	18.50 –	19.00
Oxalic, crystals, bbl.	lb.	.13½–	.13½
Phosphoric, 50% carboys	lb.	.07½–	.08½
Pyrogallic, resublimed	lb.	1.50 –	1.60
Sulphuric, 60°, tanks	ton	9.50 –	11.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	16.00 –	16.50
Sulphuric, 66° drums	ton	20.00 –	21.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp. crys., bbl.	lb.	.36½–	....
Tartaric, imp., powd., bbl.	lb.	.36½–	....
Tartaric, domestic, bbl.	lb.	.37½–	....
Tungstic, per lb.	lb.	1.10 –	1.20
Alcohol, butyl, drums, f.o.b. works	lb.	.26 –	.28
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.75 –	4.95
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.70 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.41 –	...
No. 1, 190 proof, special, dr.	gal.	.35 –	...
No. 1, 188 proof, bbl	gal.	.42 –	...
No. 1, 188 proof, dr	gal.	.36 –	...
No. 5, 188 proof, bbl	gal.	.40 –	...
No. 5, 188 proof, dr	gal.	.34 –	...
Alum, ammonia, lump, bbl.	lb.	.03½–	.03½
Potash, lump, bbl.	lb.	.02½–	.03½
Chrome, lump, potash, bbl.	lb.	.05½–	.05½
Aluminum sulphate, com., bags	100 lb.	1.50 –	1.65
Iron free bags	lb.	.02½–	.02½
Aqua ammonia, 26°, drums	lb.	.06½–	.07½
Ammonia, anhydrous, cyl.	lb.	.30 –	.30½
Ammonium carbonate, powd. casks, imported	lb.	.09½–	.10
Ammonium carbonate, powd. domestic, bbl.	lb.	.13 –	.14
Ammonium nitrate, tech., casks	lb.	.10 –	.11
Amyl acetate tech., drums	gal.	3.50 –	3.75
Arsenic, white, powd., bbl.	lb.	.14½–	.15
Arsenic, red, powd., kegs	lb.	.14½–	.14½
Barium carbonate, bbl.	ton	78.00 –	80.00
Barium chloride, bbl.	ton	85.00 –	90.00
Barium dioxide, drums	lb.	.18 –	.18½
Barium nitrate, casks	....	.08 –	.08½
Barium sulphate, bbl.	lb.	.04 –	.04½
Blanc fixe, dry, bbl.	lb.	.04 –	.04½
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.40 –	....
Borax, bbl.	lb.	.05½–	.05½
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	4.00 –	4.05
Calcium arsenate, dr.	lb.	.17 —	.18
Calcium carbide, drums	lb.	.05½–	.05½
Calcium chloride, fused, drums	ton	22.00 –	23.00
Gran. drums	ton	28.00 –	30.00
Calcium phosphate, mono, bbl.	lb.	.06½–	.07
Camphor, cases	lb.	.86 –	.88
Carbon bisulphide, drums	lb.	.07 –	.07½
Carbon tetrachloride, drums	lb.	.09½–	.10
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04½
Domestic, heavy, bbl.	lb.	.03½–	.03½
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, cylinders	lb.	.06 –	.06½
Chloroform, tech., drums	lb.	.35 –	.38
Cobalt oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	19.00 –	20.00
Copper carbonate, bbl.	lb.	.19 –	.20
Copper cyanide, drums	lb.	.47 –	.50
Copper sulphate, dom., bbl.,	100 lb.	6.00 –	6.25
Cream of tartar, bbl.	lb.	.25½–	.26½
Epsom salt, dom., tech., bbl.	100 lb.	1.90 –	2.15
Epsom salt, imp., tech., bags	100 lb.	1.00 –	1.15
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.50 –	2.60
Ether, U.S.P., drums	lb.	.13 –	.15
Ethyl acetate, com., 85%, drums	gal.	.80 –	.85
Ethyl acetate, pure (acetic ether, 98% to 100%)	gal.	.93 –	1.00
Formaldehyde, 40%, bbl.	lb.	$0.14½–	$0.15½
Fullers earth—imp., powd., net	ton	30.00 –	32.00
Fusel oil, ref., drums	gal.	3.55 –	4.05
Fusel oil, crude, drums	gal.	2.50 –	2.60
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	.90 –	.95
Glycerine, c.p., drums extra	lb.	.17½–	....
Glycerine, dynamite, drums	lb.	.16 –	....
Glycerine, crude 80%, loose	lb	.11	.11½
Iodine, resublimed	lb.	4.55 –	4.65
Iron oxide, red, casks	lb.	.12 –	.18
Lead:			
White, basic carbonate, dry, casks	lb.	.09½–	.10
White, basic sulphate, casks	lb.	.09½–	....
White, in oil, kegs	lb.	.12½–	.14
Red, dry, casks	lb.	.11½–	.12
Red, in oil, kegs	lb.	.13½–	.15
Lead acetate, white crys., bbl.	lb.	.14 –	.14½
Brown, broken, casks	lb.	.13 –	.13½
Lead arsenate, powd., bbl.	lb.	.23 –	.24
Lime-Hydrated, bbl.	per ton	16.80 –	17.00
Lime, Lump, bbl	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.10½–	.11
Lithophone, bags	lb.	.07 –	.07½
in bbl.	lb.	.07 –	.07½
Magnesium carb., tech., bags	lb.	.08 –	.08½
Methanol, 95%, bbl.	gal.	1.18 –	1.20
Methanol, 97%, bbl.	gal.	1.20 –	1.22
Nickel salt, double, bbl.	lb.	.10½–	....
Nickel salts, single, bbl.	lb.	.11½–	....
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.35 –	.40
Phosphorus, yellow, cases	lb.	.30 –	.35
Potassium bichromate, casks	lb.	.11½–	.11½
Potassium bromide, gran., bbl.	lb.	.19 –	.20
Potassium carbonate, 80-85%, calcined, casks	lb.	.06½–	.07½
Potassium chlorate, powd.	lb.	.07½–	.08
Potassium cyanide, drums	lb.	.45 –	.50
Potassium, first sorts, cask	lb.	.08½	.09
Potassium hydroxide (caustic potash) drums	lb.	.07½–	.09
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06½–	.07½
Potassium permanganate, drums	lb.	.19 –	.20
Potassium prussiate, red, casks	lb.	.70 –	.72
Potassium prussiate, yellow, casks	lb.	.36½–	.37
Salammoniac, white, gran., casks, imported	lb.	.07 –	.07½
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.08
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk)	ton	26.00 –	28.00
Soda ash, light, 58% flat, bags, contract	100 lb.	1.60 –	1.67
Soda ash, light, basis, 48%, bags, contract, f.o.b. wks.	100 lb.	1.20 –	1.30
Soda ash, light, 58%, flat, bags, resale	100 lb.	1.75 –	1.80
Soda ash, dense, bags, contract, basis 48%	100 lb.	1.17½–	1.20
Soda ash, dense, in bags, resale	100 lb.	1.85 –	1.90
Soda, caustic, 76%, solid, drums, f.a.s.	100 lb.	3.30 –	3.40
Soda, caustic, 60%, wks., contract	100 lb.	2.50 –	2.60
Soda, caustic, ground and flake, contracts	100 lb.	3.80 –	3.90
Soda, caustic, ground and flake, resale	100 lb.	3.72½–	....
Sodium acetate, works, bags	lb.	.05½–	.06½
Sodium bicarbonate, bbl.	100 lb.	2.00 –	2.50
Sodium bichromate, casks	lb.	.08½–	.08½
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04½
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.20 –	.23
Sodium fluoride, bbl.	lb.	$0.09 –	$0.10½
Sodium hyposulphite, bbl.	lb.	.02½–	.03
Sodium nitrite, casks	lb.	.08 –	.08½
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.04
Sodium prussiate, yel. drums	lb.	.16½–	.17½
Sodium salicylic, drums	lb.	.47 –	.57
Sodium silicate (40°, drums)	100 lb.	.80 –	1.25
Sodium silicate (60°, drums)	100 lb.	2.00 –	2.25
Sodium sulphide, fused, 60-62% drums	lb.	.04½–	.04½
Sodium sulphite, crys., bbl.	lb.	.03½–	.03½
Strontium nitrate, powd., bbl.	lb.	.12½–	.13
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08½
Talc—imported, bags	ton	30.00 –	40.00
Talc—domestic powd., bags	ton	18.00 –	25.00
Tin bichloride, bbl.	lb.	.12½–	.13½
Tin oxide, bbl.	lb.	.50 –	....
Tin crystals, bbl.	lb.	.35½–	.36
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.06 –	.07
Zinc cyanide, drums	lb.	.37 –	.38
Zinc oxide, , lead free, bbl.	lb.	.08 –	.08½
5% lead sulphate, bags	lb.	.07½–	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	2.50 –	3.00

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.65 –	$0.80
Alpha-naphthol, ref., bbl.	lb.	.75 –	.90
Alpha-naphthylamine, bbl.	lb.	.35 –	.37
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.24 –	.25
Anthracene, 80%, drums	lb.	.75 –	1.00
Anthracene, 80%, imp., drums, duty paid	lb.	.70 –	.75
Anthraquinone, 25%, paste, drums	lb.	.70 –	.75
Benzaldehyde U.S.P., carboys	lb.	1.40 –	1.45
tech, drums	lb	75	80
Benzene, pure, water-white, tanks and drums	gal.	.30 –	.32
Benzene, 90%, tanks & drums	gal.	.27 –	.30
Benzene, 90%, drums, resale	gal.	.30 –	.33
Benzidine base, bbl.	lb.	.85 –	.90
Benzidine sulphate, bbl.	lb.	.70 –	.75
Benzoic acid, U.S.P., kegs	lb.	.72 –	.75
Benzoate of soda, U.S.P., bbl.	lb.	.57 –	.65
Benzyl chloride, 95-97%, ref., drums	lb.	.45 –	....
Benzyl chloride, tech., drums	lb.	.30 –	.35
Beta-naphthol, subl., bbl.	lb.	.55 –	.60
Beta-naphthol, tech., bbl.	lb.	.22 –	.23
Beta-naphthylamine, tech.	lb.	.80 –	.90
Cresol, U.S.P., drums	lb.	.25 –	.29
Ortho-cresol, drums	lb.	.28 –	.30
Creaylic acid, 97%, resale, drums	gal.	1.25 –	....
95-97%, drums, resale	gal.	1.15 –	1.25
Dichlorbenzene, drums	lb.	.07 –	.09
Diethylaniline, drums	lb.	.50 –	.60
Dimethylaniline, drums	lb.	.42 –	.43
Dinitrobenzene, bbl.	lb.	.19 –	.20
Dinitroclorbenzene bbl.	lb.	.22 –	.23
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluene, bbl.	lb.	.20 –	.22
Dip oil, 25%, drums	gal.	.25 –	.30
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.80 –	.85
Meta-phenylenediamine, bbl.	lb.	1.00 –	1.05
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.09 –	.09½
Naphthalene, balls, bbl.	lb.	.09½–	.10½
Naphthionate of soda, bbl.	lb.	.58 –	.65
Naphthionic acid, crude, bbl.	lb.	.55 –	.60
Nitrobenzene, drums	lb.	.10 –	.12
Nitro-naphthalene, bbl.	lb.	.30 –	.35
Nitro-toluene, drums	lb.	.15 –	.17
N-W acid, bbl.	lb.	1.25 –	1.30
Ortho-amidophenol, kegs	lb.	2.30 –	2.35
Ortho-dichlorbenzene, drums	lb.	.17 –	.20
Ortho-nitrophenol, bbl.	lb.	.90 –	.92
Ortho-nitrotoluene, drums	lb.	.10 –	.12
Ortho-toluidine, bbl.	lb.	.14 –	.15
Para-amidophenol, base, kegs	lb.	1.20 –	1.30
Para-amidophenol, HCl, kegs	lb.	1.25 –	1.35
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.74 –	.75
Para-nitrotoluene, bbl.	lb.	.60 –	.65
Para-phenylenediamine, bbl.	lb.	1.45 –	1.50
Para-toluidine, bbl	lb.	.95 –	.98
Phthalic anhydride, bbl.	lb.	.35 –	.38
Phenol, U.S.P., drums	lb.	.54 –	.55
Picric acid, bbl.	lb.	.20 –	.22
Pyridine, dom., drums	gal.	nominal	

Pyridine, imp., drums	gal.	$2.50 –	$2.75
Resorcinol, tech., kegs	lb.	1.40 –	1.50
Resorcinol, pure, kegs	lb.	2.00 –	2.25
R-salt, bbl	lb.	.55 –	.60
Salicylic acid, tech., bbl	lb.	.47 –	.48
Salicylic acid, U.S.P., bbl	lb.	.40 –	.50
Solvent naphtha, water-white, drums	gal.	.37 –	.40
Crude, drums	gal.	.24 –	....
Sulphanilic acid, crude, bbl	lb.	.18 –	.20
Thiocarbanilide, kegs	lb.	.35 –	.38
Toluidine, kegs	lb.	1.20 –	1.30
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars	gal.	.30 –	.35
Toluene, drums	gal.	.35 –	.40
Xylidines, drums	lb.	.47 –	.49
Xylene, pure, drums	gal.	.75 –	1.00
Xylene, com., drums	gal.	.37 –	.....
Xylene, com., tanks	gal.	.32 –	.....

Naval Stores

Rosin B-D, bbl.	280 lb.	$6.10 –	....
Rosin E-I, bbl.	280 lb.	6.10 –	....
Rosin K-N, bbl.	280 lb.	6.15 –	....
Rosin W.G.-W.W., bbl.	280 lb.	6.50 –	7.50
Wood rosin, bbl.	280 lb.	6.00 –	6.10
Turpentine, spirits of, bbl.	gal.	1.22½ –	....
Wood, steam dist., bbl.	gal.	1.00 –	....
Wood, dest. dist., bbl.	gal.	.75 –	....
Pine tar pitch, bbl.	200 lb.	..... –	6.00
Tar, kiln burned, bbl.	500 lb.	..... –	13.00
Retort tar, bbl.	500 lb.	..... –	12.00
Rosin oil, first run, bbl.	gal.	.45 –	.....
Rosin oil, second run, bbl.	gal.	.48 –	.....
Rosin oil, third run, bbl.	gal.	.52 –	.....
Pine oil, steam dist.	gal.	.75 –	.....
Pine oil, pure, dest. dist.	gal.	.70 –	.....
Pine tar oil, ref.	gal.	.48 –	.....
Pine tar oil, crude, tanks f.o.b. Jacksonville, Fla.	gal.	.32 –	.32½
Pine tar oil, double ref., bbl.	gal.	..... –	.75
Pine tar, ref., thin, bbl.	gal.	..... –	.25
Pinewood creosote, ref., bbl.	gal.	..... –	.52

Animal Oils and Fats

Degras, bbl.	lb.	$0.03½ –	$0.04½
Grease, yellow, bbl.	lb.	.07 –	.07½
Lard oil, Extra No. 1, bbl.	gal.	.90 –	.92
Neatsfootoil, 20 deg. bbl.	gal.	1.30 –	....
No. 1, bbl.	gal.	.92 –	.94
Oleo Stearine		.10 –	....
Red oil, distilled, d.p. bbl.	lb.	.11 –	11½
Saponified, bbl.	lb.	.11 –	11½
Tallow, extra, loose	lb.	.07½ –	....
Tallow oil, acidless, bbl.	gal.	.94 –	.96

Vegetable Oils

Castor oil, No. 3, bbl.	lb.	$0.14 –	.....
Castor oil, No. 1, bbl.	lb	.14½ –	.....
Chinawood oil, bbl.	lb.	.25 –	.27
Coconut oil, Ceylon, bbl.	lb.	.09½ –	.....
Ceylon, tanks, N.Y.	lb.	.08½ –	.08¾
Coconut oil, Cochin, bbl.	lb.	.10 –	.10½
Corn oil, crude, bbl.	lb.	.12½ –	.....
Crude, tanks, (f.o.b. mill)	lb.	.09½ –	.09¾
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09½ –	.....
Summer yellow, bbl.	lb.	.12 –	.....
Winter yellow, bbl.	lb.	.13 –	.13½
Linseed oil, raw, car lots, bbl.	gal.	1.14 –	.....
Raw, tank cars (dom.)	gal.	1.09 –	.....
Boiled, cars, bbl. (dom.)	gal.	1.16 –	.....
Olive oil, denatured, bbl.	gal.	1.10 –	.....
Sulphur, (foots) bbl.	lb.	.09½ –	.09¾
Palm, Lagos, casks	lb.	.07½ –	.07¾
Niger, casks	lb.	.07½ –	.07¾
Palm kernel, bbl.	lb.	.08½ –	.09
Peanut oil, crude, tanks (mill)	lb.	.13½ –	.....
Peanut oil, refined, bbl.	lb.	.17 –	.....
Perilla, bbl	lb.	.16½ –	.16¾
Rapeseed oil, refined, bbl.	gal.	.83 –	.84
Rapeseed oil, blown, bbl.	gal.	.88 –	.89
Sesame, bbl	lb.	.11½ –	.12½
Soya bean (Manchurian), bbl.	lb.	.12½ –	.13
Tank, f.o.b. Pacific coast	lb.	.10½ –	.10¾
Tank, (f.o.b. N.Y.)	lb.	.10½ –	.10¾

Fish Oils

Cod, Newfoundland, bbl.	gal.	$0.70 –	$0.72
Menhaden, light pressed, bbl.	gal.	.76 –	.....
White bleached, bbl.	gal.	.78 –	.....
Blown, bbl.	gal.	.82 –	.....
Crude, tanks (f.o.b. factory)	gal.	.50 –	.....
Whale No. 1 crude, tanks, coast	lb.	.07½ –	08
Winter, natural, bbl.	gal.	.76 –	.78
Winter, bleached, bbl.	gal.	.79 –	.80

Oil Cake and Meal

Coconut cake, bags	ton	$30.00 –	$31.00
Copra, sun dried, bags, (c.i.f.)	lb.	.05¼ –	.05½
Sun dried Pacific coast	lb.	.05¼ –	.05½
Cottonseed meal, f.o.b. mills	ton	38.00 –	.....
Linseed cake, bags	ton	34.50 –	.....
Linseed meal, bags	ton	36.50 –	.....

Dye & Tanning Materials

Albumen, blood, bbl.	lb.	$0.45 –	$0.50
Albumen, egg, tech, kegs	lb.	.80 –	.85
Cochineal, bags	lb.	.35 –	.36
Cutch, Borneo, bales	lb.	.04½ –	.05
Cutch, Rangoon, bales	lb.	.13 –	.13½
Dextrine, corn, bags	100 lb.	3.64 –	3.69
Dextrine, gum, bags	100 lb.	3.99 –	4.09
Divi-divi, bags	ton	38.00 –	39.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Logwood, sticks	ton	28.00 –	30.00
Logwood, chips, bags	lb.	.02½ –	.03½
Sumac, leaves, Sicily, bags	ton	70.00 –	72.00
Sumac, ground, bags	ton	$65.00 –	$67.00
Sumac, domestic, bags	ton	40.00 –	42.00
Starch, corn, bags	100 lb.	2.97 –	3.07
Tapioca flour, bags	lb.	.05½ –	.06½

Extracts

Archil, conc., bbl.	lb.	$0.17 –	$0.18
Chestnut, 25% tannin, tanks	lb.	.02 –	.03
Divi-divi, 25% tannin, bbl.	lb.	.04 –	.05
Fustic, crystals, bbl.	lb.	.20 –	.22
Fustic, liquid, 42°, bbl.	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.08 –	.09
Hematine crys., bbl.	lb.	.14 –	.18
Hemlock, 25% tannin, bbl.	lb.	.04 –	.05
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl.	lb.	.14 –	.17
Logwood, crys., bbl.	lb.	.19 –	.20
Logwood, liq., 51°, bbl.	lb.	.09 –	.10
Quebracho, solid, 65% tannin, bbl.	lb.	.04½ –	.05
Sumac, dom., 51°, bbl.	lb.	.06½ –	.07

Dry Colors

Blacks–Carbongas, bags, f.o.b. works	lb.	$0.20 –	$0.24
Lampblack, bbl.	lb.	.12 –	.40
Mineral, bulk	ton	35.00 –	45.00
Blues–Bronze, bbl.	lb.	.55 –	.60
Prussian, bbl.	lb.	.55 –	.60
Ultramarine, bbl.	lb.	.08 –	.35
Browns, Sienna, Ital., bbl.	lb.	.06 –	.14
Sienna, Domestic, bbl.	lb.	.03½ –	.04
Umber, Turkey, bbl.	lb.	.04 –	.04½
Greens–Chrome, C.P. Light, bbl.	lb.	.32 –	.34
Chrome, commercial, bbl.	lb.	.12 –	.12½
Paris, bulk	lb.	.30 –	.35
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Oxide red, casks	lb.	.10 –	.14
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl.	lb.	1.30 –	1.32
Yellow, Chrome, C.P. bbls	lb.	.20 –	.21
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl.	lb.	$0.28 –	$0.30
Beeswax, crude, bags	lb.	.20 –	.21
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candellila, bags	lb.	.23 –	.24
Carnauba, No. 1, bags	lb.	.42 –	.43
No. 2, North Country, bags	lb.	.23 –	.23½
No. 3, North Country, bags	lb.	.19 –	.19½
Japan, cases	lb.	.16½ –	.16¾
Montan, crude, bags	lb.	.04½ –	.04¾
Paraffine, crude, match, 105-110 m.p.	lb.	.04 –	.04¼
Crude, scale 124-126 m.p., bags	lb.	.02½ –	.03
Ref., 118-120 m.p., bags	lb.	.03½ –	.03¾
Ref., 125 m.p., bags	lb.	.03¾ –	.03¾
Ref. 128-130 m.p., bags	lb.	.04 –	.04¼
Ref., 133-135 m.p., bags	lb.	.04¼ –	.04½
Ref., 135-137 m.p., bags	lb.	.05 –	.05¼
Stearic acid, agle pressed, bags	lb.	.13½ –	.....
Double pressed, bags	lb.	.14½ –	.....
Triple pressed, bags	lb.	.15½ –	.16

Fertilizers

Ammonium sulphate, bulk, f.o.b. works	100 lb.	$3.25 –	$3.30
F.a.s. double bags	100 lb.	3.85 –	3.90
Blood, dried, bulk	unit	4.25 –	.....
Bone, raw, 3 and 50, ground	ton	27.00 –	30.00
Fish scrap, dom., dried, wks.	unit	4.00 –	.....
Nitrate of soda, bags	100 lb.	2.60 –	2.65
Tankage, high grade, f.o.b. Chicago	unit	3.25 –	3.50
Phosphate rock, f.o.b. mines, Florida pebble, 68-72%	ton	$4.00 –	$4.50
Tennessee, 78-80%	ton	8.00 –	8.25
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	43.67 –	.....
Double manure salt	ton	25.72 —	.....
Kainit	ton	7.22 —	.....

Crude Rubber

Para—Upriver fine	lb.	$0.27½ –	.....
Upriver coarse	lb.	.22 –	.....
Upriver caucho ball	lb.	.25 –	.....
Plantation—First latex crepe	lb.	.27½ –	.27¾
Ribbed smoked sheets	lb.	.27½ –	.27¾
Brown crepe, thin, clean	lb.	.26½ –	.26¾
Amber crepe No. 1	lb.	.26½ –	.27

Gums

Copal, Congo, amber, bags	lb.	$0.12 –	$0.13
East Indian, bold, bags	lb.	.23 –	.23½
Manila, pale, bags	lb.	.20 –	.20½
Pontinak, No. 1 bags	lb.	.20 –	.20½
Damar, Batavia, cases	lb.	.28 –	.29
Singapore, No. 1, cases	lb.	.34 –	.35
Singapore, No. 2, cases	lb.	.23 –	.24
Kauri, No. 1, cases	lb.	.64 –	.65
Ordinary chips, cases	lb.	.18 –	.20
Manjak, Barbados, bags	lb.	.09 –	.09½

Shellac

Shellac, orange fine, bags	lb.	$0.68 –	.....
Orange superfine, bags	lb.	.70 –	.71
A. C. garnet, bags	lb.	nominal	
Bleached, bonedry	lb.	.76 –	.78
Bleached, fresh	lb.	.64 –	.65
T. N., bags	lb.	.62 –	.64

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec	sh. ton	$500.00 –	.....
Asbestos, shingle, f.o.b., Quebec	sh. ton	$65.00 –	$85.00
Asbestos, cement, f.o.b., Quebec	sh. ton	20.00 –	25.00
Barytes, grd., white, f.o.b. mills, bbl.	net ton	16.00 –	20.00
Barytes, grd., off-color, f.o.b. mills bulk	net ton	13.00 –	15.00
Barytes, floated, f.o.b. St. Louis, bbl.	net ton	28.00 –	.....
Barytes, crude f.o.b. mines, bulk	net ton	10.00 –	11.00
Casein, bbl., tech.	lb.	.21 –	.25
China clay (kaolin) crude, f.o.b. Ga.	net ton	7.00 –	9.00
Washed, f.o.b. Ga.	net ton	8.00 –	9.00
Powd., f.o.b. Ga.	net ton	14.00 –	20.00
Crude f.o.b. Va.	net ton	8.00 –	12.00
Ground, f.o.b. Va.	net ton	14.00 –	20.00
Imp., lump, bulk	net ton	15.00 –	20.00
Imp., powd.	net ton	45.00 –	50.00
Feldspar, No. 1 pottery	long ton	6.00 –	7.00
No. 2 pottery	long ton	4.00 –	5.50
No. 1 soap	long ton	7.00 –	7.50
No. 1 Canadian, f.o.b. mill	long ton	20.00 –	22.00
Graphite, Ceylon, lump, first quality, bbl.	lb.	.06½ –	.....
Ceylon, chip, bbl.	lb.	.05½ –	.....
High grade amorphous crude	ton	15.00 –	35.00
Gum arabic, amber, sorts, bags	lb.	.15 –	.16
Gum tragacanth, sorts, bags	lb.	.50 –	.60
No. 1, bags	lb.	1.50 –	1.60
Kieselguhr, f.o.b. Cal.	ton	40.00 –	42.00
F.o.b. N. Y.	ton	50.00 –	55.00
Magnesite, crude, f.o.b. Cal.	ton	14.00 –	15.00
Pumice stone, imp., casks	lb.	.03 –	.05½
Dom., lump, bbl.	lb.	.05 –	.05½
Dom., ground, bbl.	lb.	.06 –	.07
Silica, glass sand, f.o.b. Ind.	ton	2.00 –	2.50
Silica, sand blast, f.o.b. Ind.	ton	2.50	5.00
Silica, amorphous, 250-mesh, f.o.b. Ill.	ton	17.00 –	17.50
Silica, bldg. sand, f.o.b. Pa.	ton	2.00 –	2.75
Soapstone, coarse, f.o.b. Vt., bags	ton	7.00 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags	ton	6.50 –	9.00
Talc, 200 mesh, f.o.b. Ga., bags	ton	7.00 –	9.00
Talc, 200 mesh, f.o.b. Los Angeles, bags	ton	16.00 –	20.00

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$3.25 –	3.50
Corning	bbl.	1.85 –	.....
Cabell	bbl.	1.91 –	.....
Somerset	bbl.	1.75 –	.....
Illinois	bbl.	1.97 –	.....
Indiana	bbl.	1.98 –	.....
Kansas and Oklahoma, 28 deg.	bbl.	1.20 –	.....
California, 35 deg. and up	bbl.	1.04 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls.	gal.	$0.22½ –	.....
Naphtha, V. M. & P. deod, steel bbls.	gal	.21½ –	.....
Kerosene, ref. tank wagon	gal.	.14 –	.....
Bulk, W. W. export	gal.	.07 –	.....
Lubricating oils:			
Cylinder, Penn., dark	gal.	.25 –	.27
Bloomless, 30@31 grav.	gal.	.20 –	.22
Paraffin, pale	gal.	.28 –	.30
Spindle, 200, pale	gal.	.25 –	.26
Petrolatum, amber, bbls.	lb.	.05 –	.05½
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	ton	$45–50
Chrome brick, f.o.b. Eastern shipping points	ton	50–52
Chrome cement, 40-50% Cr_2O_3	ton	23–27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks.	1,000	40–46
2nd. quality, 9-in. shapes, f.o.b. wks.	1,000	36–41
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65–68
9-in. arches, wedges and keys	ton	80–85
Scraps and splits	ton	85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48–50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48–50
F.o.b. Mt. Union, Pa.	1,000	42–44
Silicon carbide refract. brick, 9-in.	1,000	1,100.00

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	$225.00
Ferrochromium, per lb. of Cr, 6-8% C	lb.	.11¼ –	.11½
4-6% C	lb.	.12 –	.13
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	120.00 –	.....
Spiegeleisen, 19-21% Mn.	gr. ton	40.00 –	.....
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00 –	2.50
Ferrosilicon, 10-15%	gr. ton	48.00 –	50.00
50%	gr. ton	95.00 –	.....
75%	gr. ton	150.00 –	160.00

Ferrotungsten, 70-80%, per lb. of W	lb.	$0.90 - $0.95
Ferro-uranium, 35-50% of U. per lb. of U	lb.	6.00 -.....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50 - 3.75

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$6.00 - $9.00
Chrome ore Calif. concentrates, 50% min. Cr_2O_3.	ton	22.00 - 23.00
C.i.f. Atlantic seaboard	ton	20.50 - 24.00
Coke, fdry., f.o.b. ovens	ton	7.00 - 7.50
Coke, furnace, f.o.b. ovens	ton	6.00 - 6.50
Fluorspar, gravel, f.o.b. mines' Illinois	ton	20.00 - 21.50
Ilmenite, 52% TiO_2	lb.	.01½- .01¾
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.33 -.....
Manganese ore, chemical (MnO_2)	ton	75.00 - 80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.65 - .70
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06 - .08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½- .12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½- .12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12
Rutile, 95% TiO_2	lb.	.12 -.....
Tungsten, scheelite, 60% WO_3 and over, per unit WO_3	unit	8.50 - 8.75
Tungsten, wolframite, 60% WO_3 and over, per unit WO_3	unit	8.00 - 8.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50 - 3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	2.25 - 2.50
Vanadium pentoxide, 99%	lb.	12.00 - 14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00 -.....
Zircon, washed, iron free, f.o.b. Pablo, Fla.	lb.	.04½- .13

Non-Ferrous Materials

	Cents per Lb.
Copper, electrolytic	15 - 15¼
Aluminum, 98 to 99%	26-27
Antimony, wholesale, Chinese and Japanese	7¼- 8¾
Nickel, virgin metal	28-30
Nickel, ingot and shot	30-
Monel metal, shot and blocks	32.00
Monel metal, ingots	38.00
Monel metal, sheet bars	45.00
Tin, 5-ton lots, Straits	41.37½
Lead, New York, spot	7.25
Lead, E. St. Louis, spot	7.00
Zinc, spot, New York	6.85
Zinc, spot, E. St. Louis	6.50

Other Metals

Silver (commercial)	oz.	$0.66¾
Cadmium	lb.	1.00
Bismuth (500 lb. lots)	lb.	2.55
Cobalt	lb.	2.65@2.85
Magnesium, ingots, 99%	lb.	1.25-.....
Platinum	oz.	116.00
Iridium	oz.	260.00@275.00
Palladium	oz.	81.00
Mercury	75 lb.	68.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	25.50
Copper bottoms	30.75
Copper rods	25.25
High brass wire	19.37½
High brass rods	17.00
Low brass wire	21.10
Low brass rods	22.00
Brazed brass tubing	24.25
Brazed bronze tubing	29.00
Seamless copper tubing	25.25
Seamless high brass tubing	23.50

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

Copper, heavy and crucible	11.60@11.80
Copper, heavy and wire	11.50@11.60
Copper, light and bottoms	10.00@10.10
Lead, heavy	5.75@ 6.00
Lead, tea	3.50@ 3.75
Brass, heavy	6.50@ 6.75
Brass, light	5.75@ 6.00
No. 1 yellow brass turnings	6.75@ .700
Zinc	3.75@ 4.25

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.29	$3.14
Soft steel bars	3.19	3.04
Soft steel bar shapes	3.19	3.04
Soft steel bands	3.29	3.19
Plates, ¼ to 1 in. thick	3.29	3.14

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Arkansas

FORT SMITH—The Fort Smith Fertilizer Co., recently organized, has plans under way for the erection of a new 1-story plant for commercial fertilizer production. Grinding, mixing, drying and other machinery will be installed. Walter Knight is president.

California

EXETER—John F. Hamburg, an official of the Engels Copper Mining Co., Mills bldg., San Francisco, is at the head of a new company now being organized to construct and operate a cement manufacturing plant on site selected near Exeter. It will consist of a number of buildings and is estimated to cost more than $2,000,000, with machinery. William F. Humphrey, attorney, Mills Bldg., San Francisco, represents the new company.

REDDING—The Swayne Creosoting Co., plans for extensions and improvements in its plant, including the installation of additional equipment.

MERCED—The Yosemite Cement Co., recently organized, is having plans prepared by the Hunt Engineering Co., Kansas City, Mo., for the erection of a new mill on 1,500-acre site acquired on the Merced River, near Merced. It will cost approximately $1,000,000, with machinery. The Agricultural Lime & Composite Co., American National Bank Bldg., San Francisco, is interested in the project. J. E. Monroe is an official of the company.

SOUTH SAN FRANCISCO—The Metal & Thermit Corp., Swift St., is taking bids for the erection of the initial units of its proposed new plant on site recently acquired, and will commence work at an early date. It will cost in excess of $1,500,000, with machinery. Headquarters are at 120 Broadway, New York. The engineering department, 1427-29 Western Axe., Pittsburgh, Pa., Frank I. Ellis, is in charge.

Connecticut

MANCHESTER—The Oxford Soap Co. has work in progress on a 3-story addition, 60x150 ft., to be equipped as a feldspar-grinding mill and will commence the machinery installation at an early date. Complete pulverizing equipment will be installed. Other extensions and improvements are contemplated for considerable increase in output.

Florida

TAMPA—The Tampa Bay Fertilizer Co., recently organized with a capital of $1,000,000, is perfecting plans for the operation of a local plant. S. W. Allen is president.

Illinois

DE PUE—The Mineral Point Zinc Co., Room 1111, 140 South Dearborn St., Chicago, has plans under way for a new smelting plant and general works on local site, to cost in excess of $1,000,000, with equipment. The Leonard Engineering Co., 37 South Wabash Ave., Chicago, is engineer. William Scott is president.

CHICAGO—The Chicago Bearing Metal Co., 2234 West 43rd St., will immediately commence erection of a new 1-story building at its plant, 35x100 ft., to cost $19,000.

Kansas

WICHITA—The Billings Paint Co. has leased a portion of the new building to be erected at Lulu and Douglas Sts., 80x120 ft., for a new works.

Maryland

HAVRE DE GRACE—The Tiger Tire Co., Toronto, Ont., is completing negotiations with the local Board of Trade for the acquisition of a site for the erection of a new branch plant for the manufacture of tires and rubber goods. Property has been donated to secure the plant, which is estimated to cost approximately $200,000, with machinery. Plans will soon be drawn.

HAGERSTOWN—The Tanners' Hide & Tallow Co. has commenced the rebuilding of its local plant, destroyed by fire a number of months ago, and plans for the installation of machinery at the earliest date, to include melting equipment, presses, grinders, etc.

BALTIMORE—The Standard Sanitary Mfg. Co., Bessemer Bldg., Pittsburgh, Pa., has authorized the immediate preparation of plans for the initial unit of its proposed new enameled products plant on site lately acquired on 5th Ave. It will consist of a number of buildings, estimated to cost in excess of $1,000,000 with machinery.

Michigan

PETOSKEY—The Northwestern Pulp & Paper Co. has tentative plans under consideration for the rebuilding of the portion of its local pulp mill destroyed by fire, May 7, with loss estimated at $100,000, including equipment.

Minnesota

ST. PAUL—The Waldorf Paper Products Co. has awarded a contract to the Steenberg Construction Co., Endicott Bldg., for the erection of its proposed new plant at 2230 Myrtle St., to be 4-story, 84x110 ft., estimated to cost $125,000, with machinery.

Missouri

ST. LOUIS—The Anheuser-Busch Brewing Association, 9th and Pestalozzi Sts., will remodel its malt house and a portion of its stock houses for a plant for the manufacture of glucose and kindred products. The improvement with equipment is estimated to cost $300,000. Work will be commenced at once.

CAPE GIRARDEAU—The Marquette Cement Mfg. Co., 140 South Dearborn St., Chicago, Ill., has purchased the local plant of the Cape Girardeau Portland Cement Co., for a consideration said to be $2,000,000. The new owner will take immediate possession and will develop plans for extensions and improvements to increase the present capacity.

ST. LOUIS—The A. Leschen & Sons Rope Co., 5909 Kennerly Ave., has awarded a contract to James Stewart & Co., Boatmen Bank Bldg., for the erection of a new building at its wire rope manufacturing plant to cost $100,000, to be equipped in part as a testing laboratory.

New Hampshire

DANBURY—The Ford Motor Co., Highland Park, Mich., is planning for the construction of a mill on garnet properties on the Wilmot highway, recently acquired from the Garnet Grit Co., for material for the polishing of plate glass. Pulverizing, grinding and refining machinery will be installed. The output will be used at the company glass plant at Glassmere, Pa., comprising the former plant of the Allegheny Glass Co., lately purchased.

New Jersey

NEWARK—The Flood & Conklin Co., 132 Chestnut St., manufacturer of varnishes, etc., has filed plans for the immediate erection of an addition to its plant to cost about $40,000.

PERTH AMBOY—The manual training committee of the Board of Education has been authorized to arrange for the purchase of a gas furnace for installation at the local school, to be used in connection with metal casting instruction.

PERTH AMBOY—A company is being organized by Emil Stremlau, Room 209, 217 Smith St., to construct and operate a local oil plant for the manufacture of a gasoline substitute. The initial works will cost about $50,000.

TRENTON—The Mercer Pottery Co., Muirhead Ave., manufacturer of general ware, will commence the erection of a 1-story

addition to cost about $15,000, exclusive of equipment.

NEWARK—The Celluloid Co., 209 Ferry St., has completed plans for the construction of a new plant addition for general increase in capacity, estimated to cost $130,000, with equipment.

METUCHEN—The Empire Floor & Wall Tile Co., Middlesex Ave., has been secured by new interests and plans are being arranged for the immediate reopening of the plant, which has been inactive for some time past. Alterations and improvements will be made in the building and machinery, with the installation of necessary operating equipment. Roy Schweiker is plant superintendent.

CARTERET—The Mexican Petroleum Co. will make extensions and improvements in its local oil works, including the erection of new buildings.

New York

FORT MILLER—Fire, May 6, destroyed a portion of the plant of the Fort Miller Pulp & Paper Co., with loss estimated at $100,000, including equipment. It is planned to rebuild.

GENEVA—The General Glass Co., Inc., recently organized by Rochester, N. Y., interests, has acquired the plant of the Geneva Glass Products Co., and will take immediate possession. The new company will expand the factory and purposes to install additional equipment for the production of glass under a recently developed process. The company is headed by Henry J. and Earl H. Crowder. Louis E. Fuller, Rochester, attorney, is representative.

North Carolina

CHARLOTTE—The Ornamental Stone Co., 129 Brevard Court, will commence the erection of a new plant, 75x300 ft., for the manufacture of precast stone products. Mixing and grinding machinery, molding apparatus and other equipment will be installed. W. F. McCanless is president; and C. J. Helms, secretary and treasurer in charge.

BEAUFORT—M. L. Wright, Beaufort, has plans under consideration for the establishment of a local plant for the manufacture of fertilizer products. Inquiries are being made for equipment.

Ohio

COSHOCTON—The Columbia Tire & Rubber Co., Mansfield, O., has acquired the local plant of the Midland Tire & Rubber Co., and will use the property as a branch works. Extensions and improvements are planned. The company will also continue its branch factory at Columbiana, O.

LISBON—The American Vitrified Products Co. has broken ground for a new 4-story plant to replace its works destroyed by fire early in March, with loss of about $100,000. New machinery will be installed. The plant is estimated to cost close to $130,000 with equipment.

NEWTON FALLS—The Newton Falls Rubber Co., lately organized, has extension and improvement work in progress at the former local plant of the Trumbull Rubber Co., acquired from the receiver, and purposes to have the mill ready for service early in June. Equipment will be provided for the employment of about 250 men. Irvin Jordan is vice-president and general manager.

Oklahoma

BARNSDALL—The Barnsdall Refining Co. has commenced enlargements in its local oil-refining plant to increase the handling capacity to about 5,000 bbl. per day. A number of new plant units will be equipped.

PONCA CITY—The Mariand Refining Co. will rebuild the portion of its local oil plant destroyed by fire recently with loss approximating $25,000.

Pennsylvania

WARREN—The Conewango Refining Co. has tentative plans under consideration for the rebuilding of the portion of its Plant No. 1, destroyed by fire, May 7, with loss estimated at $750,000, including machinery. The company is operated by the Fred G. Clark Co., 1081 West 11th St., Cleveland, Ohio.

PITTSBURGH—The Vitro Mfg. Co., 60 Oliffe St., manufacturer of enamels, oxides, etc., has filed plans for the erection of a 1-story plant addition, estimated to cost $14,000, exclusive of equipment.

FRANKLIN—Fire, May 7, destroyed a portion of the No. 3 Eclipse refining plant of the Atlantic Refining Co., with loss estimated at $33,000. It is planned to rebuild. Headquarters are at 3144 Passyunk Ave., Philadelphia, Pa.

PITTSBURGH—The National Tube Co., Frick Bldg., has taken title to property on Forbes St., 150x223 ft., to be used as a site for a new research laboratory. Plans will be drawn at an early date.

PHILADELPHIA—The Phil-Fiber Boxboard Mills, Inc., Delaware and Tasker Sts., has filed plans for the erection of a new 1-story building at its plant to cost about $14,000.

ROULETTE—The Roulette Glass Co., Corning, N. Y., recently organized with a capital of $3,200,000, is considering plans for the erection of a new plant at Roulette, on site now being selected. Dr. George S. Goff heads the company.

Texas

BRECKENRIDGE—The Magnolia Petroleum Co., Dallas, is planning for the construction of a new plant on local site for the production of carbon black, estimated to cost close to $200,000, with machinery. Application has been made for permission.

FORT WORTH—The Transcontinental Oil Co., Pittsburgh, Pa., has plans nearing completion for the erection of an addition to its local refinery, to include the installation of a new unit for gasoline manufacture, stills and other equipment, estimated to cost $500,000. O. D. Robinson is vice-president.

FORT WORTH—The Texhoma Oil & Refining Co., Wichita Falls, Tex., is planning for the erection of a new local plant for gasoline refining. It will consist of 4 units, each with capacity of 500 bbl. a day, estimated to cost close to $500,000, with machinery. W. B. Hamilton is president.

TEXAS CITY—The Marland Refining Co., operating a local oil storage and distributing works, has preliminary plans under consideration for the erection of an oil refinery in the vicinity of its present works, estimated to cost in excess of $250,000, with machinery.

EL PASO—Wells, Stillwell & Spears, Inc., has plans nearing completion for the construction of a cotton oil mill, to cost approximately $90,000. The equipment will be electrically operated.

West Virginia

MORGANTOWN—The United States Window Glass Co. has plans for the installation of additional machinery at its local plant, including gas producers and other equipment. Extensions will be built. A portion of a bond issue of $350,000, now being sold, will be used for the expansion. Walter A. Jones is president.

New Companies

LAUBEC CHEMICAL PRODUCTS CO., New York, N. Y.; chemicals and chemical byproducts; $25,000. Incorporators: H. Laut, C. Heckelman and H. Becker. Representative: Herman Gottlieb, 299 Broadway.

CAPE OIL CO., Boston, Mass.; refined oils; $3,750,000. Henry L. F. Kreger, president; and Robert Cutler, treasurer, both of Boston.

J. M. BOOTH CHEMICAL CO., El Paso, Tex.; chemicals and chemical byproducts; $10,000. Incorporators: J. M. Booth, and W. H. Pryor, both of El Paso.

JOHNSON-CARTER CORP., Newark, N. J.; celluloid and composition products; $500,000. Incorporators: Peter and Charles Johnson, George Y. Carter. Representative: Porter, Link & Lafferty, 31 Clinton St., Newark.

ELECTROLYTIC ZINC PROCESS CO., Butte, Mont.; chemical and metallurgical operations; $10,000. C. F. Kelley, Butte, heads the company.

NEWMAN PRODUCTS CORP., 526 West 18th St., Chicago, Ill.; chemicals and chemical byproducts; $10,000. Incorporators: John Newman, G. Arthur Buhl and George S. Pines.

GOOD RUBBER CO., Akron, O.; rubber products; $10,000. Incorporators: W. D. and E. K. Good, both of Akron.

MCCALL OIL CO., Oakland, Calif.; petroleum products; $125,000. Incorporators: B. B. McCall, Sr. and Jr., and H. E. Peterson. Representative: Roscoe D. Jones, Bank of Italy Bldg., San Francisco.

NORRIS FERTILIZER CO., Wilmington, Del.; fertilizers; $40,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

MOKAN CHEMICAL CO., Kansas City, Mo.; chemicals and chemical byproducts; $10,000. Incorporators: F. I. and Searcy Ridge, both of Kansas City.

ETTINGER-SMITH CHEMICAL CO., 3763 Wabash Ave., Chicago, Ill., organized; chemicals and chemical byproducts. Bernard and Michael Holtzman are heads.

LEMA TANNING CO., Salem, Mass.; operate a leather tannery; $25,000. Paul Harsfald is president, and Morris H. Levins, Dorchester, Mass., treasurer and representative.

ATLAS ROCK SALT CO., Wilmington, Del.; salt and derivatives; $100,000. Representative: Corporation Trust Co. of America, du Pont Bldg., Wilmington.

SEABOARD CRYSTAL CO., Newark, N. J.; chemicals and chemical byproducts; $100,000. Incorporators: James F. McKenna, John M. Williams and John F. Burrell, 67 Stockton St., Newark. The last noted is representative.

UNIVERSAL GYPSUM CO., Rotan, Tex.; gypsum products; $100,000. Incorporators: C. E. Williams, L. Ford and J. B. Gray, all of Rotan.

NORTHEASTERN CONCRETE TILE CO., Worcester, Mass.; concrete and cement products; 500 shares of stock, no par value. Isaac M. Freedman is president, and N. A. Fieldstad, Worcester, treasurer and representative.

TRIBOROUGH CHEMICAL CORP., Wilmington, Del.; chemicals and chemical byproducts; $20,000. Representative: Corporation Service Co., Equitable Bldg., Wilmington.

ALPINE OIL CO., San Francisco, Calif.; refined petroleum products; $50,000. Incorporators: S. Herbert Lanyon, W. S. Boggs and C. L. Froding. Representative: Thomas J. Straub, 445 Sutter St., San Francisco.

RALEIGH ASBESTOS & SHINGLE CO., 217 Pullen Bank Bldg., Raleigh, N. C.; asbestos and composition products; $100,000. Incorporators: Perrin Busbee, D. H. Winslow and C. F. Koonce.

NAKLO CO., Rumford, Me.; chemicals and chemical byproducts; $200,000. William J. Leader is president, and J. Abbott Nile, treasurer, both of Rumford. Representative: Ralph T. Parker, Rumford.

REILLY-WHITEMAN CO., Philadelphia, Pa., being organized to manufacture chemicals and chemical compounds. Application for a state charter will be made May 28. Representative: Frank A. Moorshead, Commonwealth Bldg., Philadelphia.

SUPERIOR OIL CO., Sandusky, O.; refined oils; $100,000. Incorporators: Martin J. Monahon and Albert J. Sanders, both of Sandusky.

NEW ENGLAND PORCELAIN CO., Boston, Mass.; porcelain products; $100,000. Horatio C. Rohrman, president, and H. Wray Rohrman, Winchester, Mass., treasurer and representative.

BLEKRE TIRE & RUBBER CO., St. Paul, Minn.; rubber products; $475,000. E. O. Blekre, 5025 Colfax Ave., South, Minneapolis, Minn., heads the company.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

OILS, TECHNICAL AND EDIBLE, fats, greases, tallows (raw materials and manufactured products thereof). Rotterdam, Netherlands. Agency.—6340.

OIL CAKES, FOODSTUFFS, etc., of the best quality. Malmo, Sweden. Agency.—6345.

CHEMICALS, PERFUMERY, HARDWARE, etc. Capetown, South Africa. Agency.—6346.

ROSIN AND TURPENTINE. Genoa, Italy. Agency.—6400.

BLACK DECOLORANT FOR BLEACHING PURPOSES. Turin, Italy. Agency.—6401.

DRUGS, CHEMICALS AND TOILET ARTICLES. Winnipeg, Canada. Purchase and agency.—6402.

FERTILIZERS AND CHILEAN NITRATE. Mannheim, Germany. Purchase.—6403.

CHEMICALS, DRUGS AND DRUGGISTS' SUNDRIES. Winnipeg, Canada. Purchase.—6405.

CRUDE SULPHUR, 99 per cent. and copper sheets, 4x4 ft., of various thicknesses and weights. Karachi, India. Purchase.—6406.

PAINTS. Johannesburg, South Africa. Exclusive agencies.—6420.